

ALAGAPPA UNIVERSITY

(Accredited with 'A' Grade by NAAC)
Karaikudi 630 003



DIRECTORATE OF DISTANCE EDUCATION

MBA (B & F)

049



Paper - 4.1

Computers and Banking

ALAGAPPA UNIVERSITY

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KARAIKUDI - 630 003, TAMILNADU

DIRECTORATE OF DISTANCE EDUCATION

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PAPER - 4.1
COMPUTERS AND BANKING



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COMPUTERS AND BANKING

UNIT 1

Introduction to computers: What is a computer? Brief history of computers - Early computers - Generations of computers - Uses of computers.

UNIT 2

Data representation: Simple computer system - Basic concepts of data processing - Binary number system - Octal and hexadecimal - Representation of non-numeric data.

UNIT 3

Hardware: Anatomy of computer - CPU - main memory - Peripheral controllers - Peripherals.

UNIT 4

Software: Need for software - What is software? Types of software - Software relevant to banking - Systems software - Operating systems - Language translators - Programming languages.

UNIT 5

Computerisation in Banks: Stand alone - computer system - LAN - Local processing with batch updates - ATMs - Home banking - EFT - MICR - Internet and Intranet - Inter branch reconciliation - Security considerations - Accidental damage, Power failures and malicious damage - Operational problems.

BOOKS RECOMMENDED

Bajwa K. S - Bank Mechanisation, Skylark publication

Srivastava - Computer Applications in Banks, BTC, RBI

Sanjay Soni &
Vinayak Aggarwal - Computers and Banking, Sultan Chand & Sons.

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LESSON -1

1.1 Introduction

1.2 What is a Computer?

1.3 History of Computer

1.4 Characteristic Features of Computers

1.5 Classification of Computers

1.6 Various Computer Applications

1.7 Uses of Computers

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LESSON -1

1.1 Introduction:

Early people in small groups wandered from place to place in search of food. They hunted animals and plucked fruits from trees for their sustenance. They had no contacts with other groups. And also, their needs and wants were limited. Slowly, they learnt the methods of agriculture. They domesticated some animals and made use of them for various purposes. As days passed by, the needs of mankind increased. This necessitated them to deal with other people and also with small amount information.

As civilisation grew, their possessions and dealings with others considerably increased any calculations had to be done for various purposes. This was the primary reason for them to invent a machine that world store information and make calculations. After years of continuous research, man was able to construct the COMPUTER, a calculating machine.

With the advent of computer, world has now become oneness. It has been occupying in all of our activities. It has become a part of our life. As such, everyone has to acquire computer knowledge to face this modern world Even at primary level of education, children are given computer education. All business activities are being undertaken through computers. A man to compete with the present world must possess computer knowledge. Without computer knowledge, he cannot face the world. This will become a reality very soon.

Computers have been installed in industries to operate machines and to control quality of products. Business people use them for accounting, invoicing, stock control and payroll preparation. Railways and Air corporations have employed computers to book reservations. Computers have got a major role in diagnosing diseases in hospitals they keep records about the patients.

1.2 What is Computer?

In the literal sense, computer is a device that calculates. Initially the computer was designed to perform certain arithmetic operations. It dealt with numbers only. However, the present day computer can process both symbols and numbers. Therefore, the literal interpretation of the word 'computer' is something a misnormer. In deed, the computer can read input data, transfer data, store data and retrieve data, test data by logical operations and provide results.

In this context, computer is defined as "A high speed electronic machine that accepts input data, manipulates them and produces desired result as output". Thus a computer is an electronic device with the ability.

- to accept data and instructions by the users
- to transfer or move data
- to store and retrieve data
- to perform arithmetic and logical operations and
- to produce desired results in the desired form.

Thus a computer is an electronic instruments which has the above capabilities. These capabilities are usually called input, processing memory and output.

1.3 History of Computer:

The concept of computing evolved through the centuries. The computer was not invented in a day. It has gone through several stages. In fact computing starts from the very early civilisation of 4000 years age. In olden days, people did not keep records. Ten fingers of the hand were a primitive solution. Later, stones and sticks were used. By 3500 B.C., the Babylonian merchants began to use day tablets and use clay tablets. This is how, the computing method has set its history to start.

1.3.1 Abacus:

ABACU$ was the first manual calculating device. It was developed in China. It is a rectangular wooden frame fixed with

horizontal bars. Each bar (i.e., wire) has 10 beads. The unit digit starts from the rightmost wire, representing digit 1. The beads can slide up and down the wire. We can represent numbers by moving the beads towards the horizontal bars. Arithmetic operations such as addition and subtraction can be done by manipulating the beads. An abacus can handle more digits than an electronic calculator. Still it is in use in India, China, Japan etc.

1.3.2 Napier's Bones:

It was an invention in 1617 by John Napier, a Scottish mathematician. It is a set of 10 bones arranged from left to right representing 0 to 9. Each bone is divided into 9 rows representing numbers 1 to 9. Again it is subdivided into two parts wherein resultant product of the relevant row and column is marked -left side shows the tens digit and right side shows the Unit's digit. By placing the bones side by side, products and quotients of large numbers can be obtained.

1.3.3 Slide Rule:

The slide rule was developed in 1632 by William Oughtred, an English Mathematician. He invented the sign 'X' for multiplication. It consists of two movable rulers placed side by side. Each ruler is marked off in such a way that the actual distances from the beginning of the ruler are proportional to the logarithms of the numbers printed on the ruler. By sliding the ruler, one can quickly multiply or divide directly. It is commercially available in many countries.

1.3.4 Pascal's Calculator:

Pascal Blaise, a French mathematician, invented the first adding mechanical machine in 1642. It was an improved version of the manual mechanical devices such as abacus and slide rule. It consists of a series of numbered wheels (i.e., cogwheel). Each wheel is numbered from 0 to 9 and arranged to read from left to right. The machine adds and subtracts directly, while multiplication and divisions are performed through repeated addition and division as the case may be. Even today, our conventional electric meter or taxi or autometers uses a series of cogwheels to add up data.

It is worth to note here that this machine was invented by Pascal Blaise when he was 19 years old. The authentic models of his machine are still in existence. One of the languages, PASCAL, has been named after him.

1.3.5 Charles Babbage's Analytical Engine:

In 1823, Charles Babbage, a British mathematics Professor at the Cambridge University in England, developed a machine called "Difference Engine". The Difference engine performed various mathematical functions. The successful functioning of this machine encouraged Baggage to take up the task of developing a machine which could be programmed to perform any type of calculation and print out the result automatically. He carried out his work with the financial support of the British Government. His ideas under-lying the principles of the proposed machine were a 100 years ahead of his time. The tools required to give fruition to his ideas were not available at that time unfortunately. As a result, he could not construct the machine. Due to the prolonged delay by Babbage, the British government stopped the assistance. Although he could not construct the Analytical Engine, it is impressive to note that the analytical engine contained all features of the present day computer. That is why, charles Babbage is considered to be the father of modern computer. After his death, his work was continued by Augusta Ada Byron, only daughter of poet lord Byron. She was the world's first programmer.

1.3.6 Hollerith Machine:

In the U.S.A the American Census Bureau took 7 years to complete the census work with the manual recording, sorting and tabulating. When the census work was completed, the next census would be due. The census Bureau was worried about this. It hired Dr. Herman Hollerith, a statistician, to find a solution. He designed a punched card machine called census machine to process to census data in 1887. With this machine, the census work the completed in first 3 years. He was founded the tabulating Machine Company which later merged with other companies to form the Computing Tabulating Recording Company. In 1924, the company was renamed as International Business Machines Corporation'-IBM.

1.3.7 ENIAC:

In 1944, Dr.HowardAiken of Harvard University, in collaboration with IBM, designed the first real electromechanical computer called Mark I. This, was the first machine which could be programmed to do many operations without any manual interference.

In 1947, John Mauchly and Eckart completed the first large scale electronic computer called ENIAC (Electronic Numerical Integrator and Calculator). The ENIAC took just one hour to perform calculations which the mark I took a week to perform. ENIAC would perform 400 manipulations in one second, which was a stupendous feat in those days.

1.3.8 Binary Number System:

In 1940, John Von Neumann advocated some revolutionary theories for the application in computers. These theories are i) Binary number system and ii)Storing of computer instructions and data internally in the machine. This has been the basis for the today's modern computer.

1.3.9. UNIVAC:

In 1951, the first commercial digital computer namely UNIVAC-I was devised by Eckert and mauchly. This was the first computer to have software to translate program language into machine language (ie compiler). The UNIVAC was the first machine taken up for the mass production. The success of UNIVAC prompted the IBM Corporation to launch the IBM 650 computer in 1954. It was superior to the UNIVAC and gained popularity. Since then, the IBM has been taking the lead in the field of computer production.

1.4 Characteristic Features of Computers:

The following are the characteristics of a computer:

1.4.1 Accuracy:

Computers are very accurate. Computers perform millions of operations every second and can run errorless. This is because there is no human intervention between processing operations. If at all it shows wrong result information it will be due to errors supply of information by the user provisions have been made to check the message (data/information). Parity check code is introduced as in built to check the data. If the data received is correct, then only transmission of data takes place. Thus, the results produced by the computers are accurate.

1.4.2 Speed:

The speed of a computer means the number of operation a computer can perform in a second. It is to be noted that all computer operations are carried out by electrical pulses. The electrical pulses travel at a tremendous speed. The speed of computer may be expressed in terms of seconds or no of operations. Generally, the speed is expressed in terms of seconds or even milliseconds.

Millisecond	=	One Thousand of a second
Microsecond	=	One millionth of a second
Nanosecond	=	Thousand millionth of a second
Picosecond	=	Million -Millionth of a second

The speed of the computer is determined by clock rate. Clock rates are expressed in MHz (Million of cycles per second). Now Pentium II with clock rates of 266MHz, 300 MHz, 333MHz, 350MHz and 400 MHz are largely available. In 1999, Pentium III with the clock rates of 450 MHz/500MHz has been introduced.

1.4.3 Storage:

Computer stores large amount of information/data. Each computer has its own internal memory in the CPU. The storage capacity of the memory unit is expressed in terms of kilobytes. The memory capacity of the computer can be increased through auxiliary or secondary storage devices. They are magnetic disks, CD-ROMs, magneto optical devices, fixed drives and solid state

drives. Disks store data drives of 4GB, 9GB are the currently available with maximum sizes. A single CD-ROM can contain 600MB of data. Complex softwares like MS-OFFICE'97, VISUAL C or VISUAL C++ require over 100MB storage. Therefore they are distributed as CD-ROMs. Floppy disks are available in 1.4MB capacity. The information stored in these devices can be quickly read or retrieved whenever needed.

1.4.4 Versatility:

Computers can be used for any type of application. There is no limit for its application. It can be used to solve any type of problem. An each it is a versatile machine.

1.4.5 Automation:

Computers have long been used in data acquisition and data processing. Now, they are used in control systems also. Machine tools and industrial devices are controlled by computers. Air Traffic control systems use computers. The automatic industry has employed computers to test motors and other manufacturing operations. The industrial robot is an outcome of the computer technology. Computers are now extensively used in the quality control operations. In the present day, automated teller machines for disbursing cash against credit cards is a good example of computer automation. A new class of application known as office automation system is emerging very fast. This is due to the rapid developments in electronic communications system.

1.4.6 Diligence:

If a man starts working, he becomes tired after a few hours. But the computer works for hours together. In other words, the computer is a machine which does not get tired by doing continuous repetitive tasks. As it gives a series of continuous services, it improves the quality of service of an organisation and also the quality of human life.

1.4.7 Reliability:

Since the results produced by the computers are accurate with high degree of precisions, they are reliable.

1.4.8 Capability:

If a computer is programmed once, then the same program can be executed as many times as we need.

1.5 Classification of Computers:

Computers can be classified

i. On the basis of generation
ii. On the basis of purpose for which they are used
iii. On the basis of construction
iv. On the basis of memory capacity

1.5.1 Computers on the basis of generations:

Based on the technology computers are associated to various generations:

1.5.1.1 First Generation Computers (1946-1959):

Computers, manufactured during this period, used vacuum tubes. The computers, fitted with vacuum tubes, are called first generation computers. ENIAC was of this category. This type of computers used 18000 vacuum tubes, weighed 30 tones and occupied a very large hall. The following are their characteristics:

* Large in size
* Slow operating speed
* Consumed high power
* More costlier
* Memory capacity 2 = 4096 words
* No provision to handle subprograms
* Unable to handle programming logic and non numeric problems
* Only 10 input, output instructions available Short life span

Example of this Category : ENIAC, EDVAC, EDSAC, IBM MARK-I UNIVAC, and so on.

1.5.1.2 Second Computers (1960-1964):

The second generation computers used transistor in the place of vacuum tubes. The transistor was 1/10 the size of a valve. A transistor could do the same operation 1/10,00,000 of a second, which a first generation computer did in 1/3 of a second. During this period, certain high level languages such as BASIC, COBOL, FORTRAN, ALGOL were developed for storing data and programs, magnetic disks were developed. It consumed little energy, and generated very less neat. It became smaller, faster and had greater computing capability.

During this period, system software like compilers, subroutine libraries and batch monitors emerged. The following are their special features:

* Less power consumption
* Less expensive
* High speed of operators
* Less heat

1.5.1.3 Third Generation Computers (1965-70):

The computers, built during this period, used 'Integrated Circuits'(IC). An integrated circuit, in the form of chip, consists of more than 300 transistors. The use of Ic's improved the auxiliary storage devices and input/output devices. These devices increased the data processing speed. Multi-processing and multi-programming were made possible. The use of integrated circuits lead to drastic reduction in physical size and cost. Full pledged operating systems were introduced for automatic sharing of resources of the computers.

1.5.1.4 Fourth Generation Computers (1971 onwards):

1972 is a remarkable year in the history of computers. Computers were made up of very large-scale integrated circuits (VLSI). A large scale integrated circuit contains nearly 10000 transistors grouped in a single silicon chip known as 'Microprocessor'. VLSI based computers are called microcomputers. A computer is called micro-computer for two reasons: i) if contains a micro-processor and ii) It is small in size

(i.e. miniature). Micro computers gave rise to a new class of general purpose machines called 'Personal Computers' (PC). A typical microcomputer could be placed on a desk. MS/DOS operating system of Microsoft Corporation was used as the control program. Now-a-days, MS-DOS is widely used in PCs. Amyriad application software such as Wordstar, Dbase III Plus, Lotus 1-2-3 and the like could be easily run on these machines. With powerful RAM capacity of 64MB, packages like ORACLE, SYBASE, POWERBUILDER, VISUAL BASIC and the like can be loaded and run. Multi-Media applications are special features of these powerful Microcomputers.

In a further development, keyboard has been supplemented by the mouse, as an additional input device. To add, CD-ROM (Compact Disk Drive) is another innovation during their period. The Pentium processor was introduced in 1993. Intel P6 processor was introduced in 1995, with 133-MHz. In 1996, Pentium Pro at 200-MHz came into the market. Pentium II (Pentium Pro and Unix) with 233 MHz was introduced in 1998.

1.5.1.5 Fifth Generation Computers(yet to come):

Upto fourth generation computers have dealt with numbers and characters. Now efforts are being undertaken to make the computers store and process knowledge. These computers will think and take decisions and in certain cases better than human beings. These computers will be endowed with artificial intelligence. The main goal of AI is to replicate human processes using chips. In Japan, they have already started their project in 1981. They call the machines knowledge Information Processing systems (KIPS). KIPS will work as amplifier of human thought and intelligence. It is expected by all that the fifth generation computers will be commercially available in the 21st Century.

PERIOD		CHARACTERISTICS
First Generation:		
Technology	-	Vacuum tubes for internal operation
Memory Capacity	-	10000 to 20000 characters
Operating Speed	-	Milliseconds (10^{-3} seconds)
External Speed	-	Few Thousand instructions
Peripherals	-	Punched cards, Megnetic drums, Magnetic tapes, Magnetic disks
Operating System	-	Mainly batch processing
Language	-	Machine Language
Application Area	-	Payroll processing & record keeping
General Remarks	-	Large in size
	-	Generated lot of heat
	-	Relatively Slow
	-	Expensive
Second Generation:		
Technology	-	Transistor for internal operations
Memory Capacity	-	4000 to 64000 characters
Operating Speed	-	Micro Seconds (10 Seconds)
External Speed	-	Upto 10,00,000 instructions persecond.
Peripherals	-	Magnetic tape and disks Video Display Unit (VDU)
Operating System	-	Multi Programming, time sharing and real time processing.
Language	-	Assembly Language and High Level language like FORTRAN & COBOL.
Application Areas	-	Billing, Pay roll Processing, Inventory files etc
General Remarks	-	Reduction in size and heat generation
	-	Consumed less power
	-	Increase in processing speed and reliability.

Third Generation:

Technology	-	Integrated Circuits
Memory Capacity	-	32000 to 4 million Characters
Operating Speed	-	Nano Seconds (10 Seconds)
External Speed	-	Upto 100,00,000 instructions per second
Peripherals	-	Magnetic Core, Teletypewriter terminals, visual Display Unit(VDU),Optical character Recognition(OCR), Magnetic Ink character Recognition.
Operating System	-	Remote processing, timesharing, real time, multiprogramming.
Language	-	High Level Languages
Application Areas	-	Airline system, Market forecasting, credit card billing, etc.
General Remarks	-	Small in size High Speed Needed Less Power Emergence of Micro Computers

Fourth Generation:

Technology	-	Large Scale Integrated Circuits
Memory Capacity	-	51200 to 32 Million characters
Operating Speed	-	PICO seconds(10 seconds)
External Speed	-	100 Million Instructions per second
Peripherals	-	VDU, OCR, MICR, Voice Recognition, Laser Printer, Floppy, Hard Disk, Video Disks,CD-ROM, Extended Core Storage.
Operating System	-	Time sharing, Real Time, Networks
Language	-	Non-procedural Language, Conversational Language, Concept of Artificial Intelligence
Application Areas	-	Mathematical modeling, simulation, electronic funds transfer, computer aided manufacturing, Computer aided designing.

1.5.2 Computers on the Basis of construction:

On the basis of construction and working, computers can be classified into:

i. Digital Computers
ii. Analog Computers
iii. Hybrid Computers

1.5.2.1 Digital Computers:

A computer that operates by counting is called a digital computer. Digital Computers operate on discrete quantities. Both numeric and non-numeric information are represented in the form of numerical digits. They use binary codes 0s and 1s to represent information. All operations are performed on the basis of addition. These computers can be used in all fields.

1.5.2.2 Analog Computers:

A computer that operates by measuring is called analog computer. Analog Computers measure continuously varying quantities like voltage and current. The problems are converted into equations and then to electrical signals. They give results in the form of graphs. They are useful for scientific purposes only. These computers cannot process alphanumeric Information.

1.5.2.3 Hybrid computers:

The computers, which possess the features of both digital and analog are called Hybrid Computers. In such computers, some calculations are done in the analog portion of the computer and some are done in the digital portion of the computer. In a Hospital intensive care unit, in the analog portion, patient's heart, temperature and other vital signs are measured and in the digital portion, reports are prepared on the basis of data available in the analog portion.

Differences between a Digital Computer and an Analog Computer

	Digital Computer	Analog Computer
i.	It operates by counting	It operates by measuring
ii.	It is concerned with discrete quantities	It is concerned with continuous quantities.
iii	It does not require physical analogy of problems	It requires physical analogy of problems
iv	The calculations are first converted into binary numbers	The calculations are converted into equations and then into electrical signals
v.	The output is in the form of discrete values	The output is in the form of graphs
vi	More accurate	Less accurate
vii	More memory is available	Limited memory is available
viii	High Speed	Less Speed
ix	Highly Flexible	Lacks flexibility
x	Vast Applications	Limited Applications
xi	It can process alphanumeric information	In cannot process alphanumeric information.

1.5.3 Computer on the basis of memory capacity:

Computers can be classified into four types on the basis of memory capacity:

i. Micro Computer
ii. Mini Computer
iii. Mainframe Computer
iv. Super Computer

1.5.3.1 Micro Computer:

A computer is called Micro Computer because of two reasons : i) It is small in size and ii) It contains a micro processor. In the microcomputer, CPU is a microprocessor. A microprocessor is a processor all the components of which, are on a single

integrated-circuit chip. Its storage capacity is low when compared to mini and main frame computers. The maximum word length (normally 16 bits) varies according to the configuration of the computers. It accepts most of the high level languages. It is relatively less expensive.

Micro-Computers can be sub-divided into two types:

Home Computer:

Home computers are meant for entertainment education and training. The keyboard of a home computer is integrated with CPU and the computer is interfaced with ordinary television. Vendors supply cassette tapes containing program for computer games and entertainment. Apart from this, several built in function are available. Can't find macro compiler errors.

Personal Computers:

Since personal computers are designed for personal use of individuals/small business concerns, they are called so. They are meant for professionals, small business units and office automation systems. They can be used for a variety of applications.

1.5.5.2 Mini Computers:

Third Generation Computers are minicomputers. Mini computers are multi-user systems. They have multiterminal facilities. It has only one central processing unit but has many terminals and keyboards. It may be concurrently used by 30-40 users (The figure on the number should not be taken in a strict sense) at a time. The size of a mini computers is in between the size of micro and main frame computers. It is more powerful than a microcomputer. The first mini computers were employed for scientific research, instrumentation systems, engineering analysis and industrial process monitoring and control. Now they are mostly used in business and scientific applications. They play a major role in Computer Aided Manufacturing (CAM) and computer Aided Designing (CAD). These computers are mainly used in banks and medium sized organisation for data processing purposes.

1.5.3.3 Mainframe Computers:

Mainframe computers are physically larger than micros or minis. They have large primary storage capacity. A single machine can process several hundred different programs. More than hundred users can use a mainframe simultaneously. They are used for the scientific are engineering analysis, simulations of complex design projects, aircraft designing etc. They are usually used by major corporations, government agencies, international banks, airlines, oil companies and national stock exchanges.

1.5.3.4 Super Computers:

Super computer is the most powerful of all computers. As regards capacity, speed, accuracy etc. It can not be compared with any other computers. They can process hundreds of millions of instructions per second. The computing capability of a super computer is equal to that of 40000 microcomputers. They are used for applications such as weather forecasting, nuclear science research, and aerodynamic modeling and powerful simulations in physics and university. The USA and Japan are the competitors in developing super computers. Cray Research(USA), Fujitsu (Japan) and Indian C-DAC (Centre for Development of Advanced Computing, Pune) are the manufactures of super computers. The cost of super computer is in the range of several crores of rupees. The Indian version PARAM was developed by C-DAC with the governmental subsidy.

PARAM 10000 has been installed, for the first time in the educational institution in India, at Amrita Institute of Advanced Computing, coimbatore in 1999.

1.5.4 Classifications on the basis of purpose for which they are used:

Computer can be classified according to the purpose for which they are used:

i. General Purpose Computers and
ii. Special Purpose Computers

1.5.4.1 General Purpose Computer:

A digital computer is a general-purpose computer. It is designed to perform a variety of tasks from simple arithmetic calculations to generation of charts. In other words, it can be used for both business applications and scientific applications. The computers we come across in offices and other places are general-purpose computers.

1.5.4.2 Special Purpose Computer:

A special purpose computer is one, which is designed to perform a specific job. In such computers, all the instructions are in built. The given task is performed quickly and efficiently. It cannot be used for any other task. As such, it lacks versatility. For example, electronic voting machine, computer used for the reservation of tickets in the railway station etc.

The microcomputers are built around microprocessor chips. It is possible to pack a complete microcomputer CPU on a single chip. However, several chips are usually used. One chip may be used to perform arithmetic logic and control functions. RAM chips handle primary memory storage function while microcomputers are light enough to be moved easily. They can be used by one person at a time.

1.6 Various Computer Applications:

Computers are an omnipresent entity today. It has pervaded all walks of our life. Its application are limited. Let us discuss the various areas in which computers have their applications.

1.6.1 Business Organisation:

In business organisations, computers are used for data processing on a very large scale. Pay rolls for thousands of employees are prepared with the help of computers. Every thing from writing letters to sending information is done using computers. It is now possible to send the same letter to the thousands of people by typing it just once. We can send information from one office in one city to another using E-mail.

Accounting of purchases, sales, debtors etc is done on computers. We can prepare trial balance and balance sheet daily. Financial decisions can be taken instantaneously using up to date available in the computer. Graphs and charts can be prepared. Industries having inventories of thousands of items of raw-materials and finished goods can exercise stores control through computers.

1.6.2 Industry:

Computers are being increasingly used in industries for various purposes. Most of the machinery in power plants steel plants etc are controlled and monitored by the computers. For quality control and testing purposes, computers are used. Computers are used for engineering and architectural design Engineers use them to design tools, machine parts and even entire machines. Computer aided designing (CAD) and computer Aided Manufacturing (CAM) are the latest developments in this field. For simulation purposes, computers are widely used computers controlled robots are able to do dreary and often dangerous jobs, in addition to mechanical work with greater accuracy. Computers are also used to regulate flow of petrol and air to the engine and also in the breaking system of cars.

1.6.3 Banking:

In recent times, the computers have occupied massively in the bank operations. Bank branches have been made computer controlled. With the result, millions of transactions can be handled every day. Ledger postings, preparation of passbooks, inter-branch reconciliation, foreign exchange operations and the like are carried out with the help of computers. The ATM (Automatic Teller Machine) is an example of recent development in the computerized banking, which is totally computer-controlled, you can deposit money in one branch and withdraw it from another city. Credit card management is done on the computers. Thousands of transactions are taking place in the stock exchanges. All these transactions are recorded and monitored by the authorities with the use of computers.

1.6.4 Transportation:

Railways and airlines are using computers for making reservations of tickets. Sitting in Mumbai, you can book an air ticket for travel from London to Singapore is possible due to computers, so also in the case of railways. You can book a ticket in Madurai for a journey from Kanyakumari to Delhi and vice-versa.

1.6.5 Medicine:

Computers play a vital role in the advancement of medical science. Medical research is today totally computer dependent. Doctors use computers to store information about their patients. Doctors have instant access to the latest developments in the medical field through Internet.

Sophisticated medical equipment such as CAT scan, Magnetic Resonance Imaging (MRI) scan, artificial respiration machine, gamma radiation therapy machines' were fully Computer controlled. To identify the cancer cells and to kill them, computers are used. In the field of genetic engineering, computers are extensively used.

1.6.6 Weather Research:

Computers are widely used in forecasting weather conditions. Data collected by the satellites are supplied to the super computers, which work round the clock, to predict as to how weather will change. The daily reports on weather conditions that we watch on the TV, are the analysis of data by super computers. The data relating to climatic changes, that have taken place since the earth was formed, have been fed into the computers for the purpose of analysing the whether conditions of the world.

1.6.7 Scientific Research:

Computers have become a part of any scientific research. For processing and analysing the data, computers are employed, to replace manual processing. In this way, research in all the fields has been greatly enhanced due to the development of more and more powerful computers.

1.6.8 Education:

Computer has become an invaluable tool for teaching. Teachers have started using computers to present complicated concepts in a very interesting manner. CD-ROMs on different subjects/topics are available foe demonstration purposes. Subjects like chemistry and physics are also taught through computers. Different academic courses are offered to the enrolled students through Internet.

What we have seen in the earlier paragraphs are some of the areas in which computers have made their impact and made the life of human beings easier.

1.7 Uses of Computers:

i. Voluminous of data can be stored.
ii. Data can be processed using simple repetitive procedure.
iii. Complex problems can be easily solved.
iv. Data can be converted into different types of graphs i.e. Pie diagram, bar diagram, staked bar diagram, line diagram etc.
v. We can get the results/output in the desired form. They are all highly reliable.
vi. It saves time to a larger extent.
vii. Data can be sorted on the basis of a particular field. Employees can be sorted on the basis of names or departments to which they are attached or on the basis of age etc. Sorted information can be retrieved within a few seconds and also in various combinations.

1.8 Limitations of Computers:

i. Human Intervention:

Computer can process jobs according to the instructions of the programmer. Each step must be clearly defined. It has to be operated and programmed by human beings. Hence, human intervention is required at all stages.

ii. Unable to make subjective judgment:

It processes data and gives results on the basis of the programmer's instructions. Therefore, it cannot make any judgment.

iii. Computers to be told exactly what to do:

Computer does what is programmed to do. Each and every step has to be specified by the programmer. If correct data are given, it will give correct result. If wrong data are given it will give wrong result. Hence it depends upon the way in which data are fed into.

iv. It cannot correct itself when some wrong instructions are specified.

v It lacks commonsense.

1.9 Review Questions
(Lesson-1)

1. What is a computer? What are the characteristics of computer?

2. Briefly trace the historical background of computer from the days of ABACUS?

3. Give a brief note on the history of development of computers?

4. How are computers classified on the basis of generation?

5. Write an essay on uses and limitation of a computer?

6. Compare the characteristics of different generation of computers?

7. State the features and characteristics of the fourth generation computers and capabilities of fifth generation computers?

8. How are computers classified on the basis of structure?

9. How will you classify the computers on the basis of memory capacity?

10. What are the characteristics of microcomputer?

11. State the different areas in which computers are used?

12. State the differences between Digital computer and Analog Computer?

13. Write Short notes on
    - i. General Purpose computer
    - ii. Special Purpose computer
    - iii. Home Computer
    - iv. Personal Computer

14. Write briefly the development of super computers?

15. Explain different classification of computers in brief?

LESSON - 2

2.1 Computer System

2.2 Data Processing

2.3 Objectives of Data Processing

2.4 Stages involved in Data Processing

2.5 Techniques of Data Processing

2.6 Methods of Data Processing

2.7 Number System

2.8 Binary Number System

2.9 Octal Number System

2.10 Hexadecimal Number System

2.11 Representation of Non-Numeric Data

2.12 Review Questions

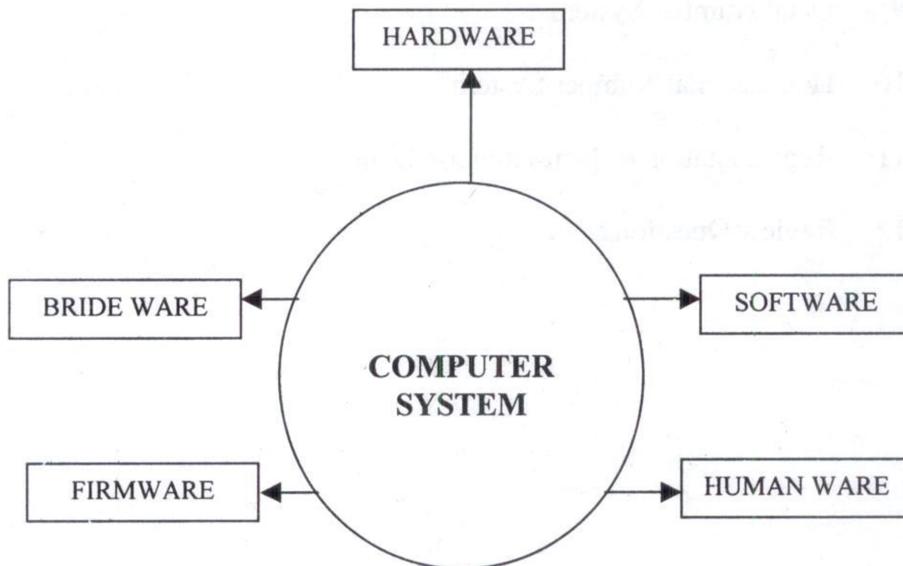
LESSON - 2

2.1 Computer System:

A computer system is a combination of various components such as

i. Hardware
ii. Software
iii. Human ware
iv. Firm ware
v. Bridge ware

The following diagram explains the computer system:



2.1.1 Hardware:

The physical components of the computer such as input device, Central Processing Unit (CPU) and output device are known as Hardware (For more details refer to Lesson -3).

2.1.2 Software:

Software is the logical and sequential series of instructions, which are given to the computer system on the basis of which it works. In simple software is a set of instruction (ie Programs) given to the Computer System to perform the desired task. There are two types of software: system software and applications software (Refer to 4.1 for more details)

2.1.3 Humanware:

People, who work the computer are collectively called Humanware. When computerisation begins, a team of people has to plan, design and implement the systems and operate the computers to effectively produce useful results. Throughout the above-mentioned processes, a number of computer professionals are needed.

System Manager: He is concerned with planning, monitoring and controlling of all activities related to computerisation.

System Analyst: He studies the problems to be solved in detail and prepares solution and program specifications.

Programmer: He prepares computer programs based on the specifications given by the system analyst.

Data Entry Operator: He operates the computer system for entering the data.

2.1.4 Firmware:

The computer programs permanently stored in ROM or PROM are called Firmware. These programs are provided by

computer manufactures along with the computers. Generally these are booting programs which help in starting the computer such programs cannot be erased.

2.1.5 Bridgeware:

The computer components and programs used to translate instruction and information written for one type of computer differ from those of other type of computer. To understand the components and programs, bridgeware is used. This is necessary when different computers are made by different manufactures.

2.2 Data Processing:

Data is the plural of the word 'datum' which means fact. Therefore, 'data' means any collection of facts. 'Data' is the raw form of information. It may be numerical or non-numerical. For example, sales figures (numerical) employee name (non-numerical) Data may be qualitative type (i.e. good, red, etc) or quantitative type (i.e.15, 234). Once the data are converted into a more meaningful form, they can be called 'information' conversation of data into meaningful information is called Data processing.

For example, details regarding employee name, basic pay, allowances, overtime hours, overtime pay, PF contribution etc is considered to be data. After processing the above data, the pay slips are prepared showing gross pay, deduction and net pay. These pay slips form information.

Data Vs Information

	Data	Information
i.	Data are raw facts	Information are finished form of data
ii.	Data are unstructured in nature	Information are structured in nature
iii.	Unprocessed representation is 'data'	Processed representation is information
iv.	This is the basis from which information is derived	This is the basis from which decision is taken

Information is generated from the data items after performing a set of processes/operations. Performing these processes in a specific sequence is known as data processing. Data processing is a series of actions or operations that convert data into useful information. Therefore, conversion of data into information is called data processing. Data processing is mainly associated with business and commercial activities, as they involve large amount of data.

2.4 Stages involved in Data processing:

Data Processing is the restructuring, manipulating or recording of data to attach value and to increase their usefulness for some specific purpose.

2.4.1 Determining data to be processed:

The first step involved in data processing is to determine what data are required to generate the required information. Such data are to be taken from source documents (source documents are those documents which contains basic data regarding particular aspect of organisation). This step assumes significance in the sense that the collection of data should be in try with the objectives of the system. In other words, this step refers to collection of necessary data fig figures to obtain desired result.

2.4.2 Input of Data:

After the collection of necessary data from the source document, the data should be inputted into the data processing system. Before that, are would be taken to make the data acceptable to the data processing system (for example: computer). Sometimes it may become necessary to code the data for quick reference. One data are coded, only codes are to be entered into the designated forms.

2.4.3 Manipulation:

It involves the process of classifying the data, sorting the data summarising the data.

a. Classifying the data:

Classification of data means organising data into related groups according to one or more charaterstics. For example: Employees may be grouped on the basis of designation etc.

b) Sorting:

After data are classified, it is necessary to arrange or rearrange the data into some logical order, so that processing can be carried out conveniently. For example: employee records may be arranged/rearranged in the ascending order/descending order alphabetically. This arranging or rearranging is called 'sorting'. It ensures identification of data, without loss of time.

c) Verification of Data:

Data are to be verified to ensure accuracy before proceeding for processing them.

d) Comparing the Data:

One set of data may be compared with another set of data for subsequent action.

e) Calculation:

To create meaningful results, arithmetical calculation has to be performed.

For example, calculation of net pay of the employees.

f) Summarising:

Data to be of value must be reduced of a meaningful form. This process is called 'summarising'. For example: How many students have passed and many students have got first class, second class and so on.

2.4.4 Output:

After the data have been manipulated. The results have to be delivered/communicated to the concerned. The distribution of processed data may be in the form of reports, tables or a document.

2.4.5 Storage:

Finally the results i.e. processed data must be retained for future if reference. Whenever need, they can be retrieved

The data processing activities can be summarized in the form of a chart as follows:

	Data Input	**Processing**	**Information**
i.	Determination of input data from source documents	Classification of data	Formal presentation of output ie results
ii.	Making data in acceptable form	Sorting of data	Analysis of data
iii.	Feeding data	Verification of data	Storage of output
iv.		Arithmetical Manipulation	Retrieval of output
v.		Summarising of data	

2.5 Objectives of Data Processing:

The following are the general objectives of data processing.

i. To handle large volume of data.
ii. To provide qualitative and quantitative information.
iii. To provide appropriate and timely information.
iv. To store information and retrieve them as and when necessary.
v. To maintain the performance of organisation at optimum level.

2.5 Techniques of Data Processing:

These are three techniques available for processing

i. Manual Data Processing
ii. Mechanical Data Processing and
iii. Electronic Data Processing.

2.5.1 Manual Data Processing:

When processing of data is done by the people, it is known as manual data processing. It is still in use in most of the concerns. In thus system, the human being collects data, manipulates then and makes output by himself. This method is applicable when the amount of data to be processed is small. However, it suffers from certain disadvantages such as time consuming process, inaccurate to certain extant, delay etc.

2.5.2 Mechanical Data Processing:

In mechanical data processing, various machines are used to perform processing operations such as arithmetic calculations, sorting and summarising of data (Electro) mechanical devices such as calculations, tabulators, are used. It goes with certain advantage such as speed, accuracy, neatness etc.

2.5.3 Electronic Data Processing (EDP):

It involves the use if computers. The computers has become a powerful tool for data processing because of its capability to store large amount of data, the speed with which it performs and of its capacity to produce results with high degree of accuracy. Electronic Data Processing implies Data Processing by computer.

2.5.4 Methods of Data Processing:

Computer system process the data with speed, accuracy and efficiency. However, its efficiency depends mainly on the way the computer system is utilised. Central Processing Unit (CPU) of the computer performs millions of instruction per second, depicting its speed. Human beings cannot interact with

the computers at such speed. Even though the human beings feed the data at high typing speed, the CPU has to wait a lot for the data input thus wasting its time which would be better utilised for processing. Another reason is that the I/O (Input/ Output) devices are basically mechanical devices. They are slow in data transfer, thus again wasting the time of CPU. To overcome these two restraints, many innovation have been made both in hardware and software so that many users use the computer simultaneously, using the CPU time properly and profiably.

With the aim to achieve optional efficiency, the following different methods have been used for data processing:

i. Batch Processing
ii. On - Line Processing
iii. Real time Processing
iv. Time sharing
v. Multi-programming
vi. Multi-processing
vii. Multitasking
viii. Distributed Processing
xi. Spooling

2.6.1 Batch Processing:

Batch Processing was a predominant concept when punched cards were used to input data. It was introduced to reduce human intervention during job processing even now, in data processing, this is the most common approach. In batch processing, data to be processing are entered into the computer. When data get accumulator over a period of time in large volumes the actual processing starts. For example, in a bank branch, all the bank transaction are entered as and when the customers transact business with the bank. At the end if every week, the transaction effected by the customers are processed and a statement of account is prepared by the computer with the accumulated data. Finally it is provided to the customers. The other examples are preparation of mark statement, pay bill preparation etc.

Several jobs are put together to form batches. The computer system takes up the jobs one by one, i.e. it takes up another job

when one job is completed. This task is supervisied by a batch monitor. Data are entered usually off-line in isolation of CPU through data entry terminals. Bathched data are accessed equantially for the purpose of processing and printing with the advent of multi-tasking and multi programming, batch processing is losing its significance.

This method has several advantages and certain disadvantages

Advantages:

- Effective utilisation of the CPU.
- At the time of processing, it does not require operator intervention.
- Suitable for application which need to be performed periodically.
- There will always be a processing delay.

Disadvantages:

- Data can be processed only at a fixed time internal.
- Any enquiring between intervals cannot be answered.
- It reduces timeliness in some cases.
- Thought it is an efficient method from the computer's point of view, each job has to wait in line for its turn at each step.
- It is difficult to provide the desired job scheduling.

2.6.2 On-Line Proccessing:

On line processing is that of processing where the result of data processing is available immediately. On line refers to the fact that all the devices are connected directly to the computer so that input for processing can be made at any time.

The data are fed through an input device called keyboard under CPU control directly the user, the necessary data are processed and then the desired result is given. A part from immediate processing, files can be updated. Information contained in any record can be accessed by the user without the necessity of

sequential search of the file. Also the user can get the result immediately. Using on-line processing, the bank customers in a computerised branch their bank balance and get a statement of his reservation, inventory control, share dealings is stock exchanges etc.

Difference between Batch Processing and On-Line Processing

	Batch Processing	On-Line Processing
i	Data are put together in Bathches	Data to be processed are fed as and when they occur.
ii	Processing takes place only after data get accumulated at a fixed time in internal.	Processing takes place immediately each transaction occurs.
iii	Devices are not directly connected to the CPU	Devices are directly connected to the CPU.
iv.	Data are entered through data entry terminals, in isolation of CPU.	Data are entered through keyboard under CPU control.
v.	Data can be accessed sequentially.	Data can be accessed at random.
vi	It reduces idle of the computer system(CPU)	The CPU may all be Effectively used, then leading to idle time in certain cases.

2.6.3 Real Time Processing:

Under Realtime Processing, the user can have direct contact with the computer through his terminal. Here the data is processed the instant of occurs. There will be no delay between the time data is available and the time it is processed. Many remote stations may be connected directly by appropriate communications equipment into the central processors files may be updated currently and enquiries may be answered by immediate access. For example, rockets are controlled by computers. The computer has to react fast to any variation in the physical system of the rocket. Any delay will cause heavy disaster.

The essential features of real time data processing are

i. Direct connection between the user and the central processor.
ii. Two way communication between the user and the central Processor.
iii. Immediate response on receipt of a message.
iv. It operates in multi-programming and multi-processing.
v. The operation system (or) programs are essential to receive enquires and to respond.
vi. The hardware and software requirements are

   a) Remote Terminals
   b) Data communication terminals such as modem, multiplexer, telephone lines.
   c) A large computer with sophisticated operating system software.
   d) Large storage area to hold the operating system software, application programs and data
   e) Direct access files permanently on line.

It is to be noted that real time processing should not be confused with online processing. For example: the system that collects production of data from the terminals in the factory and later utilities them for coasting/payment purposes is not a real time processing system. In the system provides immediate information, if may be termed as real time processing system. And also all on line systems need not necessarily to real time processing systems. In the case of real time processing system, the master files containing basic data is readily available on line for access.

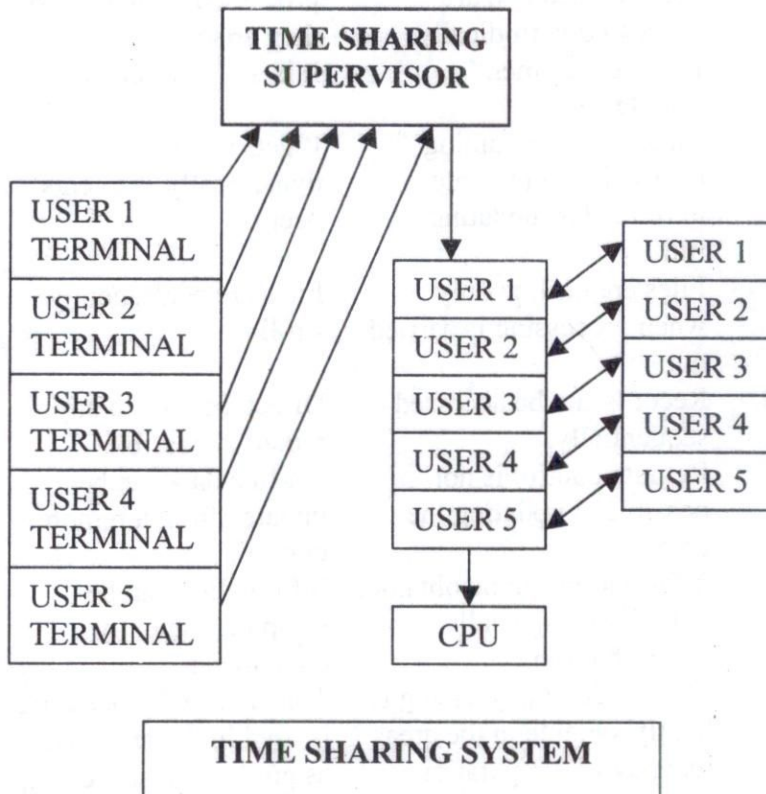
The application areas of real time systems are:

- enquiries about customer's account in banking
- Airlines Booking
- Air and ground traffic control
- Production Control
- Musical Diagnosis
- Space navigation

	Batch Processing	Real Time Processing
i	It is commonly used processing method.	It is unique in the sense that it requires unique hardware and software to handle complex processing.
ii.	Data collected are processed in batches at a fixed interval of time.	Data collected are subject to immediate processing.
iii	It requires sorting prior to processing	It does not require sorting
iv.	Transactions get accumulated and are processed periodically	Transactions are processed as and when they arise.
v.	It is measurement oriented.	It is action oriented
vi	Master fiie containing data will be upto date until the last updating run.	It gets updated dynamically as events occur.
vii.	Files are on-line only when processing is carried out.	Files are permanently on-line
viii.	Records can be accessed sequentially.	Direct access to any record is possible.
ix.	Remote control is not possible in updating the data.	On-line data can be updated from a remote control.
x.	Information can be obtained only during specially accessible run.	Information can be setup permanently on demand.
xi.	This mode of processing is highly suitable in the areas like payroll preparation, customer billing, invoicing, stock ledger etc.	This made of processing is used in the areas such as production scheduling, inventory control, airline operations, aircraft seat reservations etc.

2.6.4 Time Sharing:

In a time sharing processing method, many video terminals are attached to the computer. If there are 50 terminals, then 50 users can operate the computers simultaneously. Each user occupies a terminal and feeds program through the terminal. Then the program is sent for compilation. If any error is detected by the compiler, it will displayed on the screen. The user can correct it. After making correction, the program is sent to the CPU for execution. Thus, the time sharing operating system shares the CPU time with each of the user so that the user need not wait for his turn. If there is no other user occupying the other terminals then the whole of the CPU is made available to the only user. If two or more terminals are occupied, then the CPU time is shared by the users.



TIME SHARING SYSTEM

Thus the central processor switches from one using station to another to do a part of each job in the allotted time slice until the work is completed. It gives an impression to the user that no one

else is using the computer. In this way, the central processor provides each station (i.e. each user) to obtain instant response in an interactive conversional mode, with greater speed.

It has the following characteristics:

i. Each user has more or more input/output devices connected to the central computer.
ii. Each user can act independently of others.
iii. The central computer accepts data/instructions simultaneously from many users and allots a small portion of computer time to each user.
iv. Data files of the users are maintained at the central computer.
v. Each user can have a separate set of programs and can access to a set of public programs.
vi. It may be designed for a single organisation or a chain of organisation.

Advantages:

- It reduces central processor's idle time.
- It provides quick response.
- It avoids duplication of software.
- It permits the user to access several application programs.
- It improves input accuracy, as input data are subject for verification.
- It provides the facility of remote terminals.

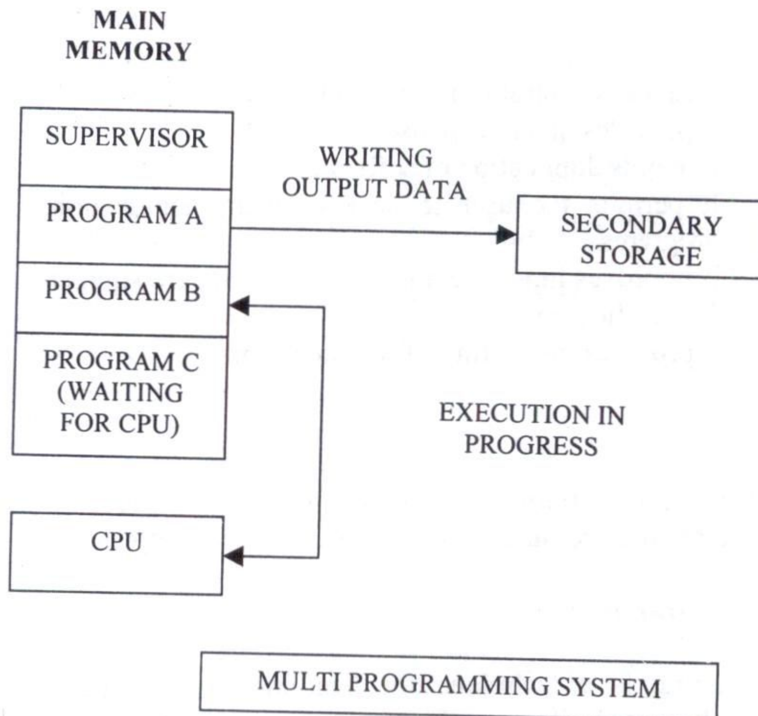
Disadvantages:

It suffers from certain disadvantages such as problem of reliability, Problem data communication; problem of security etc.

2.6.5 Multiprogramming:

Multi programming is a technique for handling two or more programs simultaneously by overlapping or interleaving their execution. This system operates on the basis of the I/O interrupt concept. It uses two distinct functional units the control unit and

I/O control unit, having direct access to the memory. It can execute several programs by rotation or by priority. In this system, a number of programs belonging to different users are simultaneously fed into the computer. These programs are kept in the main memory of the computer. A system software called monitor is permanently kept in the main memory. The monitor schedules the CPU's time to these programmer. For example, there are three programs (p1,p2,&p3) fed into the computer simultaneously. First the monitor sends p1 to the CPU. The CPU executes p1 and sends the result. Suppose any error is found in p1, then the monitor takes back p1 from CPU and sends it for correction. Immediately the monitor sends p2 to the CPU for execution, and so on. The same procedure is repeated for the other programs. In this manner, the CPU will be completely engaged. And also a number of programs a can be simultaneously executed. The main drawback of this method is that even after the mistake in the first program (p1) has been corrected, the user of the program has to wait for the CPU time.



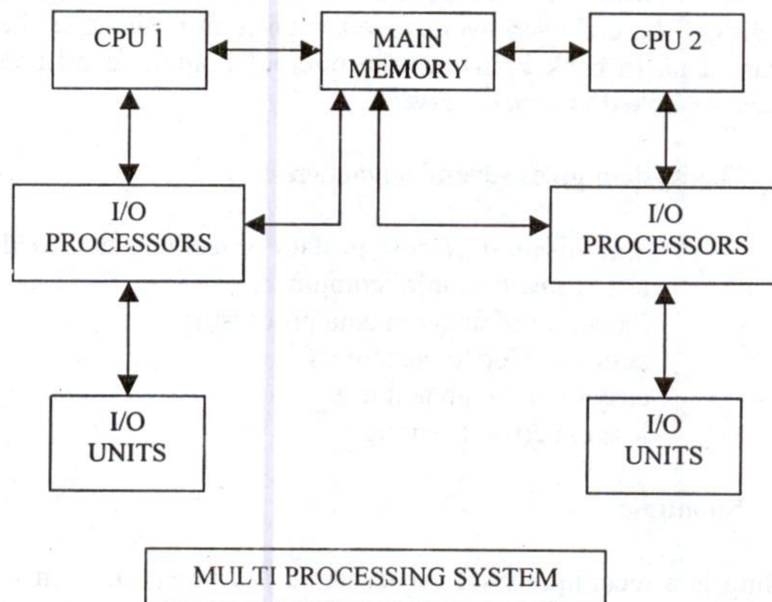
MULTI PROGRAMMING SYSTEM

The Multi Programming system has the following characteristics:

i. It handles two or more programmers simultaneously
ii. It operates on the basis of I/O interrupt concept
iii Primary memory is divided into partitions so that each program is allotted sufficient amount of memory.
iv. Programs operating in real time get top priority while programs operating on line get low priority.
v. The operating system shares the resources of the computer among a number of programs.

2.6.6 Multi processing System:

It also executes a number of programs simultaneously. The computer system has more than one microprocessor sharing a common memory. Each control unit operates independently and executes its own program. This system enables two or more computers to interact. It is possible to use a small computer to perform all preparatory tasks (i.e. feeding of data) and a big computer to interact with the database. Thus, small computers may be used to feed data to one larger computer that interacts with the database.



MULTI PROCESSING SYSTEM

2.6.7 Multitasking:

A computer executes only one program at a time. With the sophisticated hardware and software, now the computers can perform several jobs (sets of allotted programs) and several tasks (sets of allied jobs) together in rotation. Such most computers are known as multi-job or multi-task computers most microcomputer operating system and multitasking capability. With this capability, two or more performed simultaneously. Similarly application like word processing and financial analysis may be processed concurrently. The number of programs, that can be run concurrently, depends upon the amount of memory available. In effect, a single computer acts as if it were several computers.

It uses multiple central processors to serve multiple real time applications/multiple classes of users. Each central processing unit performs a particular class of users. Data processing jobs are distributed among the processors. The central processors are located at the same site or they are geographically scattered and connected by data communication lines.

Now-a-days, many companies prefer to use network of smaller computers instead of using larger computer system. It is easier to network microcomputers. It supports workgroup computing. The end users work together on joint projects as they can state data. In bank branches, the microcomputers at different counters are linked to a main server.

This system gives several advantages:

- minimisation of cost in data processing due to the use of low cost mini computer.
- reduction of delay in data processing
- better service to customers
- easy to maintain and use
- less expertise is enough

2.6.9 Spooling:

Spooling is a technique used for dynamic job processing. In this system, input and output operations occur simultaneously with

processing operations. Input data from low speed devices is stored temporarily on high-speed secondary storage units to form a queue which can be quickly accessed by the CPU output data is also written high speed into tape/disk units and form another queue which uses slow speed device (i.e. printers). The jobs are transferred when the output devices are available. The operating system controls the spooling process with the help of a special writing program. With this technique, the CPU works at its maximum speed because of slow input/output devices.

2.7 Binary Number System:

Through decimal system is a natural fallout of the fact that our hands have ten triggers, it is a land mark in our civilisation. 0 to 9 are used to form a decimal number. A combination of these symbols gives rise to a number. These ten symbols are called 'digits'. The weight of each digit is some power of 10. In other words, it has a base of 10. The value/weight of a number is determined by the relative positions of the symbols. For example 418 has the following decimal weights:

4 * 100 (10_2)	=	400
1 * 10 (10_1)	=	10
8 * 1 (10_0)	=	8
		418

Besides decimal number system, there are few other number systems

Number System	Base	Symbols
Binary	2	0,1
Terniary	3	0,1,2
Octal	8	0,1,2,3,4,5,6,7
Decimal	10	0,1,2,3,4,5,6,7,8,9
Hexadecimal	16	0,1,2,3,4,5,6,7,8,9 A,B,C,D,E,F

2.8 Binary Number System:

The digital computers use Binary system. Binary means 'two'. As we know, the computers are operated by electronic pulses. The presence of pulse indicates 1 and absence of pulse indicates 0. That is, in this system, the radix is 2 and the positional weight are the person of 2 computers use binary codes (i.e. 0 and1) to represent the numerals alphabets and special characters.

In binary number system, to form a number, we have to use only two digits i.e. 0 and 1. They are known as bits (binary digits). For example, 101 is a binary number. The equivalent decimal value is 5. A binary number is identified by a subscript of 2 at the end of the binary number and a decimal number is identified by a subscript of 10 at the end of the decimal number. For example $(10111)^{2}$" stands for a binary and $(958)^{10}$" stands for a decimal.

Decimal to Binary:

A decimal number can be converted into a binary number by dividing it by a repeatedly until the number is exhausted and the remainders give rise to the binary equipment.

75(10)	=	?
2/75		reminder
2/37		1
2/18		1
2/9		0
2/4		1
2/2		0
1		0

Thus decimal 75 is equal to $(1001011)^{2}$

Binary to Decimal:

A binary number can be converted into its equipment decimal number with the digits and its weight

$(101101)^{2}$ = (?)10

$(101101)^2 = 1*2_5+ 0*2_4+1*2P_3+1*2_2+0*2_1$
$= 32+0+8+4+0+1$
$= (45)_{10}$
(or)

32	16	8	4	2	1
1	0	1	1	0	1

Binary Addition:

The rules regarding binary addition are as follows:

0+0	=	0
1+0	=	1
0+1	=	1
1+1	=	10
1+1+1	=	11

For Example:

Add 1000
110
?

Binary	Decimal
1000	8
110	6
1110	14

ii. Add 1011000 to 111011

Carry 111

```
1011000     88
 111011     59
----------  -----
10010011    147
```

Binary Subtraction:

Binary Subtraction rules are as follows:

0-0	=	0
1-0	=	1
1-1	=	0
0-1	=	1

It is to be noted that borrowing 1 from the previous highest place is equivalent to 2.

```
Subtract      11      from   1001
carry         12

            1001
              11
             110
```

Binary Multiplication:

Binary Multiplication is the name as in the decimal system:

```
11101* 101   =    11101
                  00000
                  11101
                  10010001
```

Binary Division:

The method is the same as in the decimal division.

```
            100011 / 111
then            101
            ---------
            100011
            ---------
            111
            ---------
                111
                111
            ---------
                  0
            ---------
```

It is understood from the above that all arithmetic operations are done by the computer in terms of addition. **An** result, number of steps are increased.

1224

However, the computer performs all operation at a fast rate.

2.9 Octal Number System:

It has a base of 8. The symbols used are 0,1,2,3,4,5,6 and 7. These numbers have the same meaning as in decimal symbols. The digit position corresponds to the power of 8. An octal number is converted into a decimal by multiplying each octal digit by its weight. A decimal is converted into an octal by dividing it by 8 successively until the number is completely exhausted. The remainders form the equivalent.

Example1: $(45)_8 = (?)_{10}$

$4 \times 8^1 + 5 \times 8^0 = 32 + 5$

$= (37)^{10}$

Example 2: $(272)_8 = (?)_{10}$

$2 \times 8^2 + 7 \times 8^1 + 2 \times 8^0 = 128+56+2$

$= 186_{10}$

Example 3: $426_{10} = (?)_8$

	Remainder
8/426	
8/53	2
6	5

$426_{10} = 625_8$

If the number has fractional part, then it is multiplied by 8 successively and the carries will form the fractional part of octal equivalent.

Example 4:

$(345.218)_{10} = (?)_8$

	8/345	remainder
	8/43	1
	5	3
	.218	.616
carries	8	8
	-------	-------
	1.744	4.928
	8	8
	-------	-------
	5.952	7.424
	8	

	7.616	

Ans $(531.15747)_8$

Binary Fractions:

As in the case of decimal number system, the binary number system also has fractional part. The weights of the fractional part of the right are $2^{-1}, 2^{-2}, 2^{-3}$ i.e. 1/2,1/4,1/8...

Example1: $(0.11)_2 = (?)$
1/2+1/4 = $(0.75)_{10}$

Example : $(0.1101)_2 = (?)_{10}$

1/2 +1/4+0/8+1/16 =

i.e. 1/2+1/4+1/6 = 0.5+0.25+0.625

$(0.1101)_2 = (.8125)_{10}$

Example3: $(110.101)_2$

Integer Part:

168421

110

4+2+0 = 6

Fractional Part:

0.25	0.25	0.25	0.625
1	0	1	

Hence 0.5 + 0.125 = 0.625

$(110.101)_2 = (6.625)_{10}$

Example 4:

$(76.725)_{10} = (?)_2$

Integer part:

	remainder
2/76	
2/38	0
2/19	0
2/9	1
2/4	1
2/2	0
1	0

1001100

Fractional Part:

Carries	.725
	2

1	.450
	2

0	.900
	2

1	.800
	2

1	.600
	2

1	.200
	2

0	.400
	2

0	.800
	2

1	.600 and so on.

Ans:

$(76.725)_{10} = (1001100.10111001)_2$

2.10 Hexadecimal Number System:

0 to 9 and A to F are used to a form number in this system. It has a base of 16. The symbols A,B,C,D,E and F have their values as 10,11,12,13,14 and 15 respectively.

Decimal to Hexadecimal:

A decimal is converted into hexadecimal by dividing it by 16 and the successive form its equivalent.

$(3618)_{10} = (?)_{16}$

16/3618	remainder
16/226	2
14	2

$(3618)_{10}$ = $(E22)_{16}$

$(2480)_{10}$ = $(?)_{16}$

16 / 2480	remainder
16 /155	0
9	11--> B

$(2480)_{10}$ = $(9B0)_{16}$

Hexadecimal to Decimal:

The weight of the digit position of hexadecimal number is given below:

$...16^3, 16^2, 16^1, 16^0, 16^{-1}, 16^{-2}, 16^{-3}...$

A hexadecimal number is converted into decimal by multiplying each digit by its weight and the sum there of well form the decimal.

Example: $(F9D5)_{10} = (?)_{10}$

$= F \times 16^3 + 9 \times 16^2 + D \times 16^1 + 5 \times 16^0$

$= 15 \times 16^3 + 9 \times 16^2 + 13 \times 16^1 + 5 \times 16^0$

$= 61440 + 2304 + 208 + 5$

$= (63957)_{10}$

(or)

4096	256	16	1
F	9	D	5
15	9	13	5

$61440 + 2304 + 208 + 5 = 63957_{10}$

Example 2 : $(F9D5.39)_{16}$ = $(?)_{10}$

Integeral Part : $(F \times 16_3) + (9 \times 16_2) + (D \times 16_1) + (5 \times 16_0)$

Fractional Part: $(3 \times 16^{-1}) + (9 \times 16^{-2})$

i.e. $3/16^1 + 9/16^2$
i.e. $0.1875 + 0.0351$
i.e. 0.2227

$(F9D5.39)_{16} = (63957.2227)_{10}$

Hexadecimal to Binary:

For a given hexadecimal number, find binary equivalent for each hexadecimal digit, The binary equivalent of all the digits will form its equivalent.

Example:

	$(A9F)_{16}$	=	$(?)_2$
	A (i.e.10)	9	F (i.e.15)
	1010	1001	1111
Hence	$(A9F)_{16}$	=	$(1111\ 1001\ 1101\ 0101)_2$

Binary to Hexadecimal:

First separate the binary numbers into four digit groups starting from right to left and then convert each group into its hexadecimal.

Example:

$(10110101)_2$ = $(?)_{16}$

1011 0101

11 5
B 5

$(1011\ 0101)_2$ = $(B5)_{16}$

Equivalent Numbers in different number system

Decimal	Binary	Octal	Hexadecimal
0	0000	0	0
1	0001	1	1
2	0010	2	2
3	0011	3	3
4	0100	4	4
5	0101	5	5
6	0110	6	6
7	0111	7	7
8	1000	8	8
9	1001	9	9
10	1010	12	A
11	1011	13	B
12	1100	14	C
13	1101	15	D
14	1110	16	E
15	1111	17	F

Hexadecimal to Octal:

Step 1: Convert the given hexadecimal into 4-digit binary for each digit.

Step 2: Group the binary numbers thus obtained into binary numbers of 3 from the right end.

Step 3: Convert the binary numbers, thus grouped, into octal.

Example: $(9B5)_{16}$ = $(?)_8$

	9	B	5
ie	9	11	5

binary in 4s: 1001 1101 0101
binary in 3s

(from right): 100 111 010 101

Octal value: 4 7 2 5

Ans: $(9B5)_{16} = (4725)_8$

Octal to Hexadecimal:

$(764)_8 = (?)_{16}$

	7	6	4
binary in 3s	111	110	100

binary in 4s

(from right): 0001 1111 0100

Find Hexa value 1 15 4

1 F 4

Ans: $(764)_8 = (1F4)_{16}$

Octal / Hexadecimal system - why?

What is the necessity for learning octal/hexa while binary number system is in use in the computer? Supposing, a user wants to instruct the computer to store 43837. Then he has to say 1010101100111101 in binary. The computer will occupy larger number of bits of memory space. If he represents it in hexadecimal as ABED, it will require less number of bits in memory. That is why representation of data in octal/hexa has been developed for the user's convenience.

2.11 Representation of Non-numeric data (i.e. character):

The computer can store numeric data such as 18,62,-12,.... as a string of bits. If we want to store a character (character implies English alphabets, both/lower and upper uses, special symbols and 10 decimal digits), the computer does not put the character in the memory location. Instead, it puts a number, which is assigned to the particular the character. There are two systems available for representing the characters.

i. American Standards Committee for Information Interchange (ASCII) and

ii. EBCDIC (Extended Binary Coded Decimal Interchange Code)

These two codes are the most popular codes for representing characters in the memory location of the computers. It is to be noted that 5 is not the same as'5'. The former is a numeric whereas the letter is character we cannot make operations on '5'. So also for storing the address of a person say '4 middle street, we should use the character '4' and not the number 4.

The following table given the ASCII code for some characters:

Character	Binarycode
A	100 0001
B	100 0010
..	....
Z	101 1010
BLANK	010 0000
(	010 1000
9	011 1001

Any discrete element can be represented by binary codes. For example, musical notes, colour of the spectrum and the like can be represented. When a character is typed through the keyboard, the corresponding binary code is stored. For example if you enter 'KARAIKUDI' it is stored as follows:

K A R A I K U
1001011 1010010 1001001 1010101 1001001 1000001 1000001

D I

1001011 1000100

Special 6-bit,7-bit and 8-bit codes have been developed and standardised for representing characters in memory.

2.11.1 Binary Coded Decimals:

We supply input data into the computer in decimal numbers. Since the computer systems use binary digits, it requires conversion of decimal to binary. Conversion of binary to decimal is required when getting the output from the computers. Therefore Binary coded decimal (BCD) was developed. Under this system, decimal numbers are coded by using binary numbers. 4 bits are used to represent each digit of a decimal number. Hence if may require more memory space. For example to represent a decimal number 164, a total of 12 bits (3 digits x 4 bits) are required.

164 ----> 0001 0110 0100

And also each bit is to be given a weight, depending upon its position. In the ordinary binary form, to represent 164, it requires only 8 bits (i.e. 10100100) If we use 4 bits to represent a decimal number under the BCD code, we can code upto 15 different values. If we use less bits i.e. 3 bits, we can code only 8 different values. Though BCD representation is useful, forming complements of number is very difficult. To overcome this difficulty, Excess-3 code has been developed.

2.11.2 Excess -3 Code:

As stated earlier, it is very difficult to take complement of BCD number. To overcome this difficulty, Excess - 3 code has been developed. In this system, we add 3 to the decimal number, which needs to be converted. And then, the number, thus incremented by 3, is represented in BCD code. For example, if we need to convert decimal number 6 to Excess-3 code, add 3 to the decimal number 6 and then represent 9(6+3) in BCD code. (i.e. 1001). It is to be noted that Excess -3 code is not a weighted code.

The following table gives the Excess -3 code for decimals 0 to 9 with their BCD

Decimal	BCD	Excess -3
0	0000	0011
1	0001	0100
2	0010	0101
3	0011	0110
4	0100	0111
5	0101	1000
6	0110	1001
7	0111	1010
8	1000	1011
9	1001	1100

Consider a number 423, when coded in excess -3, it is 0111 (i.e. 4+3) 0101 (i.e. 2+3) 0110 (i.e.3+3) complement of this binary code is 1000 1010 1001 (1 becomes 0 and 0 becomes 1) which is the decimal 576 expressed again in excess-3 system. The result is the 9's complement of 423(i.e. 999-576).

This concept has led to the weighted code 2,4,2,1code. By complementing each binary expressed in this code gives 9s complement of a decimal digit. For instance, decimal 3 in 2,4,2,1 code is 0011. Its complement is 1100, which is decimal 7. The following table shows the 2,4,2,1code representation for decimals 0 to 9.

Decimal	2	4	2	1
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	1	0	1	1
6	0	1	0	0
7	0	1	0	1
8	1	1	1	0
9	1	1	1	1

This representation is highly useful in electronic calculation.

2.11.3 ASCII (American Standard code Information Interchange):

Input to computer may be in numeric form or in alphanumeric form. The computer manufactures developed their own codes to represent alphanumeric information (consisting of characters, numerals and special characters) in the earlier days. There was no standard representation of alphanumeric information. The code used for alphanumeric representation differed from one manufacturer to another. To overcome this difficulty, the computer manufactures and data processing users developed in 1960 by name ASCII (pronounced as asskey).

It was approved by the American National Standards Institute (ANSI). The manufacturers should implement this code on their systems.

ASCII - 7:

The 7-bit ASCII code offered 128(2) different combinations. It has 52 binary values for alphabets, 10 for numerals and 66 for special characters. It is considered to be an improvement over BCD code. It is still being implemented on all the computer systems. For example, character 'A' is represented as 1000001.

ASCII - 8:

The 8 bit-ASCII code was developed with the option that the manufactures would have an option to implement other ASCII-7 or ASCII-8 on their systems. The 8 bit-ASCII can made 256(2^8) different binary representations i.e.256 different characters can be represented.

For instance, character A is represented in binary as 01000001.

Many new special characters have been incorporated in the code. Facilities are there for printing double size and utilised characters. Today both ASCII -7 and ASCII-8 are equally popular among the computer manufacturers.

2.11.4 EBCDIC (Extended Binary Coded Decimal Interchange Code):

The EBCDIC is the second most commonly used code after ASCII. It was developed by the IBM. It can be used on IBM mainframe computers and other computers that code and hence it can represent 256 characters. EBCDIC can be transformed into ASCII. This enables to link up computers of various types.

Each EBCDIC character is represented by 8 bits. The first four bits are referred to as 'zero bits that identify group classification of a character. The next four bits are referred to as 'numeric bits'. The following table shows EBCDIC representation

Characters	Zone bits	Numeric bits
0 to 9	1111	0000 to 1001
A to I	1100	0001 to 1001
J to R	1101	0001 to 1001
S to Z	1110	0010 to 1001

The decimal number 25 is represented is EBCDIC as follows

Zone bits	Numeric bits	Zone bits	Numeric bits
1111	0010	1111	0101

The zone bit tells the CPU that it is handling numeric data

To represent character D,

Zone bits	Numeric bits
1100	0100

2.11.5 Parity -check bit:

The computer has to frequently move data from one location to another while performing internal operations. To ensure that data, read into storage, have been correctly moved, a self-

checking feature is available in the computer. This self-checking feature is called parity check. It is an additional bit to the existing 8 bits. The additional bit is known as 'parity bit'. In EBCDIC, the parity bit is denoted by C.

There are 2 types of parity bit, even parity bit or odd parity bit. Even parity exists in the computer system, the computer requires that the total number of 1 bits remains even. If odd parity exists, the total number of 1 bits should remain odd.

For example character A in EBCDIC is represented as 11000001. The number of 1 bits is 3. In the case of odd parity bit:

0	11000	0001
parity bit	zone bits	numeric bits

It keeps number of 1 bits odd. In the case of even parity bit:

1	1100	0001
parity bit	zone bits	numeric bits

It keeps number of 1 bits even.

When data are read into the computer, parity bit activated to ensure that the data are accurately moved between computer storage areas or between peripheral devices. It is to be noted that the parity checking system is built into the computer circuitry itself. If it is lost parity error will occur.

REVIEW QUESTIONS

1. What are the components of a computer stem? Explain in details?
2. What do you mean by data information and data processing? State the objectives of Data Processing
3. What do you mean by Data Processing? Discuss various methods of data processing systems in brief.
4. Compare Batch Processing and Real Time Processing.
5. Compare Batch Processing and On - Line Processing.
6. Write short notes on
   i. Multiprogramming
   ii. Multiprocessing
   iii. Multitasking
7. Compare the essential features of Batch Processing, Real Time Processing and Online processing.
8. Discuss Real time processing and Time sharing
9. What are the different number systems available? What type of number system is used in computer and why?
10. Compare Binary Number System and Hexadecimal Number System?
11. What are the characteristics of octal number system to hexadecimal number system?
12. Briefly explain the need and use of character codes. ASCII and EBCDIC
13. Write short notes on
    i. Binary coded Decimals (BCD)
    ii. Excess - 3 code
14. Convert the following
    $(101010)_2 = (?)_{10}$
    $(101111)_2 = (?)_{10}$
    $(101101)_2 = (?)_8$
    $(111011)_2 = (?)_8$
    $(464)_{10} = (?)_2$
    $(525\ 125)_{10} = (?)_2$
    $(146)_8 = (?)_{10}$
    $(146)_8 = (?)_{10}$
    $(C574)_{16} = (?)_2$
    $(C574)_{16} = (?)_{10}$
15. How will you represent non-numeric data in computers?

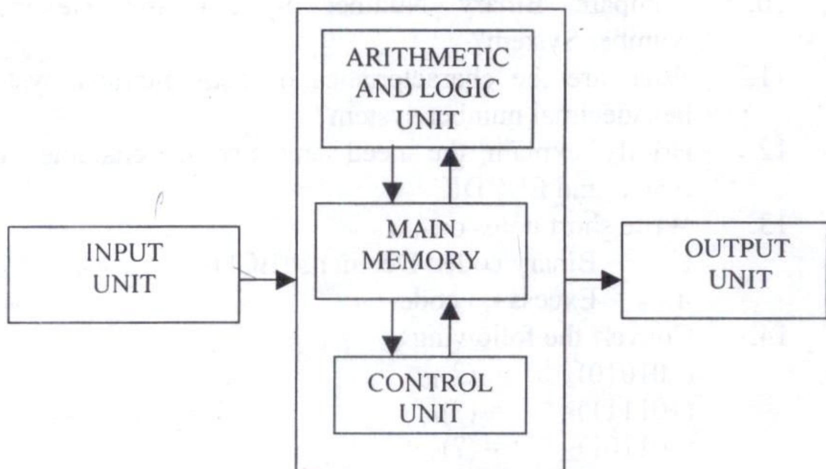
LESSON - 3

3.1 Basic Principle of Operation of a Computer:

Nowadays, most of the computers being used are digital computers. Though they may vary in constructional details, the basic principle of operation is almost the same. A computer is a collection of machines such as central processing unit (CPU) and peripherals (input and output devices). It performs the following functions

i. Accepting inputs
ii. Memory manipulation
iii. Arithmetic operations
iv. Decision making and
v. Giving output

We can explain how these functions are performed by the computers with the help of block diagram.



A computer has essentially three units. They are

i. Input Unit
ii. Output Unit
iii. Central Processing Unit (consisting of memory unit, control unit and arithmetic and logic unit)

3.2 Input Unit:

1225

Input device is a device through which data/programs are entered into the computer. It reads and accepts the data/programs and then it passes them to the memory unit of CPU. Some commonly used devices are:

i. Keyboard
ii. Mouse
iii. Joystick
iv. Magnetic Ink Character Reader (MICR)
v. Optical Character Reader (OCR)
vi. Bar coding
vii. Magnetic Disks
viii. Magnetic Tapes
ix. Floppy Disks
x. Hard Disks
xi. CD - ROM
xii. Optical Disks

3.2.1 Keyboard:

The keyboard is the standard input device. It resembles a typewriter keyboard. It is used to feed all sorts of data as well as programs in various languages. Since it is connected to the computer system through the serial port, we can feed data on-line.

It contains the alphabets A-Z, a-z, numerals 0-9 and special characters (arithmetic symbols, special symbols and punctuation characters). In the market, keyboards with 101 or 104 keys are available. These are alphanumeric Keyboard used for entering textual information. For inputting graphical information, special type of keyboards is available.

General-purpose keyboards have cursor control keys and function keys. Function keys are meant to perform a specific operation. With a single stroke, the user can achieve a specific operation. For example, if we press F3, it will display the recently typed command on the screen. Cursor control keys are used to position the cursor on the screen.

3.2.2 Mouse:

A mouse is a pointing device attached to a computer. It is a small device. We can hold it in hand. This device is called mouse because it has a small body and has a long tail. It is used instead of a keyboard. It rolls on a bearing and has two or three buttons. We can keep it on a flat surface and move it around. When we move the mouse on a flat surface, the screen cursor moves in the direction of the mouse's direction. As stated earlier, it has two or three buttons. When the button is pressed, a signal is sent to the computer. The effect is similar to pressing the 'ENTER' key on the keyboard. We can position the cursor with the help of mouse. It is used for drag operations also. To indicate a choice from various options, to perform a specific task, mouse is used. The mouse is mainly used in graphic packages.

3.2.3 Joystick:

By using joystick, children can play with computers. It is difficult for the children to use keyboard it is either convenient or comfortable for small children to use the keyboard to perform any action. With the help of joystick, any type of action (for example to move the car on the screen quickly) can be done. In other words, it is used to move the screen cursor around the screen.

In another type of movable joystick, the stick is used to activate switches that cause the screen cursor to move at a constant rate in the direction selected. Eight switches are programmed to cause movement in 8 different directions. They are arranged in a circle. Using these, the cursor may be moved in anyone of the 8 directions.

3.2.4 Magnetic Ink Character Reader (MICR):

MICR is widely used by the banks to process the tremendous volume of cheques. The cheques are precoded with cheque number, branch number etc at the bottom of the cheques. These numbers and other special symbols are printed by means of special ink containing iron oxides. When a customer presents such a cheque to his bank, the amount written on it is encoded in magnetic ink at the lower right corner. In order to read the cheque,

MICR reader-sorter, special equipment, is used. It reads the cheques by magnetising the magnetic ink characters. The cheques are then sorted into a bin of the reader-sorted. This equipment can sort about 2400 cheques per minute with a transfer rate of above 300 characters per second. Thus, it facilitates easier sorting, tabulation and posting of cheques to the relevant accounts.

Present day, credit cards are other forms of magnetic data entry system. On the reverse of the credit card, the dark magnetic stripe contains the iron oxide. Customer account and identification number is recorded on the stripe. Such cards are read by Automated Teller machine (ATM), credit card authorisation terminals and magnetic stripe readers.

3.2.5 Optical Character Reader (OCR):

OCR is software, which directly reads any printed character. No special ink is required. It compares the scanned character with a previously stored character. In other words, it examines each character against a set of patterns stored in the computer. If it matches or nearly matches, it accepts such character otherwise such character will be rejected. It is to be noted that only a limited set of typefaces and fonts can be stored. OCR can read at the rate of 2400 characters per second. However it is generally designed to read at a lower speed of 300-800 characters per second so that it is accurate. Optical scanning of text and graphics is popular in DTP (Desk Top Publishing) applications.

OCR is widely used in credit card companies, banks etc.

3.2.6 Bar Coding:

Bar Code Readers are commonly used in super markets and department stores. A bar code is a pattern of printed bars on products. The bar code render converts the bar code into product number. A light sensitive detector is used to identify the bar code and convert individual bar pattern into numeric digits. The converted numeric digits are fed into the computer as if they are fed through a keyboard. Then they are processed.

The Universal Product Code (UPC) bar coding on packages food items, books and other products has become very common.

3.2.7 Magnetic Disks:

Magnetic disks are used as input/output device. A magnetic disk is similar to gramophone record coated with ferromagnetic materials. It rotates at very high-speed. Magnetic disks are the most popular medium for Direct Access Storage Device (DASD). As such, we can have direct access to any information, irrespective of its location on the disk.

The surface of a magnetic disc is divided into number of invisible tracks ranging from 200 to 1500. The tracks are further divided into sectors, block etc. The sectors and blocks have their own addresses to facilitate location of data. The disk moves on a vertical rotating shaft, rotating at a speed of 2400 to 3600 revolutions per minute.

There are two types of disks

i. Floppy Disk
ii. Hard Disk

Advantage Of Magnetic Disks:

Magnetic disks have the following advantages:

i) We can access the data directly. Any on-line disk record can be accessed and updated. No sorting is necessary.

ii) Disk storage is much durable than magnetic tape. Data on the disk are not likely to be lost due to mishandling.

iii) Disk records can be stored sequentially or they can be stored for direct access processing.

iv) A single input transaction can be used to simultaneously update the on-line disk records of several related files.

v) It is reusable. Now data can be entered, erasing the old data.

DISADVANTAGES:

i) Disk storage is more expensive than magnetic tape.

ii) It is difficult to replace than a reel of tape.

iii) When the records in a disk file are updated, the old records may be erased when the new records are written on the disk.

iv) The files may be manipulated and destroyed.

3.2.8 MAGNETIC TAPE:

Magnetic tape is used an input/output device. It is used in computers as external storage device. It is a plastic tape coated with magnetic material such as ferrous oxide. The tape is wound on spools. The spool can be loaded onto the tape deck and in turn the deck is connected permanently to the central processor. Through this processor, information can be fed into or read from the tape.

It is similar to tape-recorder cassette (i.e. an audiotape) in respect its function and structure. It provides serial access. When any information is required, one will have to run the tape from initial position to that point where it is recorded. Magnetic tape is frequently used to transport software from one computer site to another.

Data are recorded by electromagnetic pulses on the iron oxide side of the tape. Data can be retrieved again and again. It can be used indefinitely as the old data on the tape are erased when new data are entered in the same location.

The most commonly used tape length is 2400 feet. The first and last 25 feet can not be used for holding data. The packing density is usually 6000 characters per inch. The tape can move fast the read/write heads at about 200 inches per seconds. The data are transferred into the CPU at the rate of 300000 characters per seconds (latest machine can transfer upto 12,00,000 characters per second).

ADVANTAGES:

i) It is a compact medium of storing data.

ii) It has greater data density (nearly 20 million characters per reel of tape).

iii) There is no limit to the size of a record/file.

iv) Data can be erased and rewritten.

v) The data transfer speed is much faster than that of other medium.

vi) It is easier to handle magnetic tapes. It can be kept in fireproof vaults.

vii) As it employs the internal code of the CPU, there is no transaction problem.

viii) It has long life.

ix) It is an easy means to transfer information from one computer to another.

DISADVANTAGES:

i) We cannot access data directly, as records are processed sequentially.
ii) Dust and uncontrolled humidity may cause tape-reading errors.
iii) As tapes have to be loaded and unloaded, it requires human intervention.
iv) It is not human readable.
v) If an error is detected, or a new record is to be inserted, the entire tape has to be processed.
vi) It cannot be encoded manually.
vii) It is difficult to recover from partly error.
viii) To dismount, we have to rewind the tape.

3.2.9 FLOPPY DISK:

In mini microcomputers, floppy disks are used as secondary devices to hold large amount of data. Floppy disks are circular. It is coated with a magnetic material. It is available in three sizes of 8,5.25 and 3.5inch diameters. A floppy disk has several tracks on which information is stored. The 8inch disk has 77 tracks, 5.25inch disk has 40 tracks and 3.5inch disk has 80 tracks per side (disk may be single-sided or double-sided). Single sided disks record data on tracks on one side of the disk. Double-sided disks record data on both sides of the disk. By using certain encoding techniques, double density storage can be achieved.

Regarding storage capacity, it is difficult to give precise figures. However, the following will be the data regarding storage capacity of different size disks.

Size	Storage	Tracks per side	Sectors per side	Type	Characters that can be stored
5.25"	200 KB	--	--	Single sided	2,00,000
5.25"	360 KB	40	9	DSDD	3,68,640
5.25"	1.2 MB	80	15	DSHD	12,28,800
3.5"	720 KB	80	9	DSDD	7,37,280
3.5"	1.44 MB	80	18	DSHD	14,74,560

(Source: Tamil computer, June 28 - July 11, 1999 p18)

Tracks on floppy disks are divided into sectors. Each track has 26 sectors, to accommodate data. A magnetic head is used to record and retrieve data. When the data is inserted into the slot of the floppy drive and locked, it is fixed on the hub, which rotates at a constant speed of 300-360 rpm. A read-write head (i.e. magnetic head) moves across the surface to read/write the data. Once the data have been entered on the disk, they are entered into the CPU by the magnetic reader.

i) Data can be read/written randomly.

ii) It is a permanent storage until new data are written in the same location.

iii) It provides for virtually unlimited offline storage.

iv) It is cheaper.3.25 inch disks are available at Rs.20 or less.

v) Fast access time and very fast transfer speed.

DISADVANTAGES:

i) It has to be handled carefully.

ii) It may be affected by heat and magnetic field.

iii) When records in the disk files are updated, the old records may be erased by writing the new records on the same disk space.

iv) It is not human readable. It requires machine interpretation.

v) Since the disks are more exposed to outside elements, they tend to be less reliable.

3.2.10 HARD DISKS:

Floppy disks are portable. Unlike floppy disks, fixed disks are stacked together and they are not removable. They are also called 'hard disk' or winchester disk. The term 'Winchester's originally used by IBM as a code name for their 3340 disk model. The 3340 was a removable disk. The term is now applied to any sealed unit disk drive with aerodynamic head. The hard disk contains several disks compressed together to provide higher storage capacity. The principle of reading/writing is same as floppy disks. As the disks are permanently fixed and enclosed, they rotate at high speed. This enables higher storage capacity and faster access.

3.2.11 CD-ROM:

Main memory in the computer is used to store information. It can hold small amount of information. To hold large amount of data, secondary storage devices such as magnetic tape, magnetic disks are used. Similar to floppy disks, we have another secondary storage device called 'optical disk'. This can hold huge volume of data. It is also a rotating storage device and used lasers to write information onto the disk and read information from them. An example of optical disk is CD-ROM (Compact Disk Read Only Memory) information are already recorded by the manufactures. We can only read the information. Hence, it is a read only device. It is to be noted that it cannot be updated.

The disk is formed from a resin such as poly-carbonate and coated with a metal of highly reflective surface. We can record data as well as music. Its storage capacity is 774.57MB bytes. This is equivalent to more than 550*3.25 inch disks.

ADVANTAGES:

1. The storage capacity is much greater than the other storage media.
2. The information stored on it, can be replicated inexpensively.
3. It is removable.

Another type of optical disk, where we can write information once only and the information can be read many times, is WORM (Write Once Read Many). A disk is prepared in such a way that it can be subsequently written once with a laser beam. Thus, a customer can write once as well as read the disk. It (5.25inch optical disk) can hold 650 MB. It is portable i.e. it can be removed from the drive. It shows higher reliability and has longer life.

3.2.11 Others:

Scanner:

Scanner is used to take any image. It stores the images on the hard disk or floppy disk. The images, thus stored, can be edited, retrieved or printed out suitably in any size whenever required.

Visual Display Unit:

This is the most popular on line data entry system used in modern personal computers and also in mini computer. This has a screen (like a TV screen) and a keyboard. When a key on the keyboard is pressed, corresponding character immediately reaches the memory of the computer and simultaneously that character appears on the screen.

Voice Drive:

A voice drive is an input device where the computer responds to the speech of a person. A microphone is used to convert human speech into electrical signals. The signals are transmitted a computer where they are compared to a dictionary of patterns that have been previously placed. When a close match is found, the world is recognised and the computer produces the appropriate output. Here the computer has to be trained by the speaker by repeating a particular word several times so that the computer is able to recognise the voice patterns. But still no system exists which can recognise an unlimited number of words.

Light Pen:

The light pen is a pen shaped device attached to the terminal. It is similar to the touch screen. It has a photocell placed in a small tube. When the user moves the pen over the screen, it is able to detect the light coming from the screen area. The light coming from the screen area activates the photocell. And then the electrical originals are transmitted to the cell and necessary function is carried out. With the light pen, the user can draw directly on the screen. It is highly useful to Computer Added Design (CAD).

Input Tablet:

The input tablet is a work surface. It contains hundreds of copper lines that form a grid. The grid is connected to the computer. Each copper line receives electrical impulses. A special pen attached to the tablet is sensitive to these impulses and is used to form drawings. A designer may place any design over the tablet and move the pen over it. The tablet senses the exact position of the pen and transmits the information to the CPU.

Touch Screen:

This is in fact a form of visual display unit. A keyboard is attached to it just like a normal personal computer system. We can alter the data entered through the keyboard just pointing finger to the appropriate menu option displayed on the screen. It has enhanced graphic facilities. Innovation if requires a specialised CRT display unit. When a finger points to the appropriate area, it initiates the desired function.

3.3 Output Devices:

After the data are processed, the output from such process may be required in two forms it may be in a form readable by the user in a printed inform or if the information is required for subsequent processing, it may be necessary to store on storage devices. In certain cases, the user may require the output to be displayed on the screen. Therefore, on the basic of above requirements, output devices may be classified into three types:

i. Stored output:

- Magnetic Tape
- Magnetic Disk (Floppy Disk & Hard Disk)

ii. Printed Output:

- Printers
- Plotters

iii. Displayed output

- Visual Display Unit

3.3.1 Stored Output (Refer to 3.2.7, 3.2.8, 3.2.9, 3.2.10)

3.3.2 Printed Output

Output may be in the form of printed matter or may be visible or audio type. We can broadly classify the output into two:

i. Hard Copy
ii. Soft Copy

Hard Copy refers to the output in printed or plotted form, which can be directly readable. It produces a permanent record on media such as paper sheets/paper tape. Softcopy refers to the output in magnetic form that cannot be used directly. It does not produce a permanent record.

The hard copy devices are

i. Printers
ii Plotters

The popular soft copy devices are

i. Visual Display Unit
ii. Liquid Crystal Display and Audio Response Unit

Printers:

Printers are the most common output devices, used for getting hard copy. They can be divided into two categories:

i. Impact Printers:

- Line Printers
- Several Printers (Dot matrix printer daisy wheel printed Golf ball printer)

ii. **Non-impact printer**

Ink Jet printer
Laser

Line Printers:

Line Printers are of dot matrix type. There are two types of line printers: Drum printers and chain printers. Drum printer has a metallic drum on which characters A to Z and numeric characters 0 to 9 are embossed. Printing is done by rotating. A line is printed for every one rotation of the dram. The speed of a drum printer ranges from 300 lines per minute to 3000 lines per minute. In the case of chain printers, all the characters of a line are sent to a temporary storage where they are encoded into electronic pulses. These pulses induce the appropriate hammers. Impressions of the characters are obtained through the striking of hammers over the inked ribbon.

Dot Matrix Printers:

These are most commonly used printers today. The head has either a 9, 14, 18 or even 24 pins. In this printer, characters are formed as a matrix of dots by means of thin print wires. In other words, the font or typeface and size are generated by combination of dots. Hence it is called dot matrix printer. By continuous over striking, it forms character. Letters generated by repeated over striking can be near letter quality prints. By using, large number of pins, the letters appear to be more solid. Since matrix is made up of dots, the printer is capable of printing graphic images or pictures. Dot matrix printers have a speed of 350 characters per second (CPS). For rough grafts, 200cps is enough while for fair copes, 50cps is recommended.

Dot matrix printers are available in two sizes: 80 column printers and 132 column printers.

Daisy Wheel Printers (Letter Quality Printers):

A wheel with character (lower case and upper case) and numerals is used as a prime element in this type of printers since

the wheel looks like a daisy flower, it is named so. The head moves round in such a way that the character, to be printed, is positioned on the stationery. It is hammered from front and the character is struck, on the stationary. The quality of print is clear and sharp. It has a speed of upto 60 cps.

Golf ball printers:

The print head is in the shape of golf ball, where characters are embossed in rows. The ball is rotated in vertical direction to see the each row is brought to the printing position and characters are selected by horizontal rotation. These print at up to 30 characters per second. It is used in small concerns.

Page Printer:

As speed and resolution are felt significant now-a-days, page printers have come into being. It can produce a page with various styles of printers and graphic images Non-impact Printers: Printers which make impressions without touching or without giving an impact on the paper are called Non-impact printers. They are classified into different types. Some of the popular printers are Thermal printer, laser printer and inkjet printer.

Thermal Printer:

This is actually a variation of the impact dot matrix type. The method of printing the characters is similar to that of the dot matrix printer, except that the impression is produced thermally. It uses hot needles, which burns the chemical on the special paper to form characters. The paper used is heat sensitive paper. It is popular in portable terminals.

Laser Printer:

It is similar to Xerox machine. It has a copier drum, which is sensitive to light. At first the printer writes the output on the copier drum. An electric charge is created on the copier drum uniformly. Then the laser beam is set to seam the drum by employing lense, to discharge unwanted portions. Thus, charged powder i.e. toner is applied on the drum. A special ink sticks on the

drum. The character format is transferred into the paper by heat and pressure method. Laser printers are capable of printing 10-15 pages per minute. The toner cartridge has to be replaced every 3000 pages of printing.

Laser printers can generate both graphic as well as text as image outputs. Since the output quality is good, it is used in Desk Top Publishing.

Ink Jet Printer:

It can also produce text and graphics. In the early days, the inkjet passed through an electric fields and required an electric charge. The charged ink globules were deflected to produce characters on the paper. Any excess ink was diverted into a collector and recollected back to the ink reservoir. This printer does everything silently and prints upto 10 pages per minute. It had certain drawbacks such as poor quality print at high speed, unable to make multiple copies.

In the modern inkjet printers, these drawbacks have been overcome. A modern printer produces character near qualify prints also at high speed. However, such printers require special papers.

Plotters:

Plotters are used for producing line drawings. Plotters using pen or inkjet approaches. Plotters using pen are of two types: flat bed plotters and drum plotters.

When the size of drawing is small, we can use flat bed plotters. Here the paper is fixed on a plain surface. The pen is moved freely on the surface, keeping the paper in tact. Two motors are used to move the pen. One to move the pen on the X-axis and the other on the Y-axis. The electronic circuitary takes care of the proper movement of the pen.

When a drum device is used, the paper is placed over the drum. The drum rotates back and forth to produce motion. Here the paper moves along with the pen to make the drawings. The pen moves on the X-axis and the paper moves on the Y-axis. The

electronic circuitary takes care of the movement of the pen and paper in order to draw the desired drawings. The speed of the drum plotter is higher than that of the flat bed plotter.

The plotters are used

- for graphical drawings.
- In the computer aided designing (CAD)
- To draw machine drawings, civil engineering drawings and printed circuit board layouts.

Displayed output:

Visual display unit (VDU):

It consists of a keyboard and a CRT (Cathode Ray Tube). By means of keyboard, it is possible to interact with the computer and the instruct it to display information on a cathode ray tube (CRT). Here the keyboard is the input device and the output is displayed on the CRT in a textual form. A VDU is sometimes called a dump terminal or simply a terminal.

The VDU, attached to a keyboard, serves as a general purpose terminal used for translating data. The terminal can act as an input device as well as an output device. When it acts as an input device, we can see on the screen (monitor) the data, which is being transmitted to the CPU. As an output device, it displays the information on the screen, getting it from the CPU. The main advantage in the terminal is that we are able to correct the data before it is transmitted. VDU is generally capable of displaying both alphanumeric characters as well as diagrams and pictures.

The monitor plays an important role it offers the maximum comfort for our eyes. The important characteristics of the monitor are its resolution, scanning rate and colour palette. The resolution refers to the precision with which the characters are formed. In other words, it means the maximum number of points that can be displayed without overlap. The character image depends upon the resolution. The number of dots, that are available, determines the resolution of a character. The dots are known as pixels or picture elements. When the pixels are more, the resolution will be high.

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The other characteristic is the colour palette. It refers to the number of colours that are available. It is to be noted that all colours cannot be displayed simultaneously. We need more memory to display many colours with high resolution.

The monitors can be classified on the basis of size, resolution etc. monitors can be either monochrome or colour. Monochrome monitors have only colours against a particular background i.e. green against black, orange against black, white against black etc. colour monitors are useful for applications which require combinations of various colours.

Graphic Display Devices (GDD):

Graphic display devices have very high resolution and colour features. These devices also use the same CRT monitor to display colour pictures. GDD are able to produce pictures by using combinations of phosphors. By combining the emitted light from different phosphors a range of colours is generated.

i. Direct View Storage Tubes (DVST):

It stores the picture information. Two electron guns are used, one to store the picture patterns and another to maintain the picture display. Complex pictures can be displayed without flicker.

ii. Plasma Panel Display (PPD):

With the advent of portable computers, the plasma panel display has come into the limelight. The CRT cannot be easily used in the portable computers due to its bulkiness. However, plasma display quality is slightly inferior to that of the CRT.

iii. LCD and LED:

Liquid crystal display and Light Emitting Diodes - these devices use light emitted from diodes or crystals (instead of phosphors or neon gas) to display the picture an auxiliary memory is used to store the screen patterns for display.

Central Processing Unit (CPU):

The Central Processing Unit is the nerve centre of the system. It not only performs the central control function but also it makes all the computational, logical and operational decisions. It contains Arithmetic and Logic Unit (ALU), Control Unit and main memory as its components. In other words, ALU, Control Unit and Memory Unit are together called the Central Processing Unit (CPU). The set of instructions and data are fed in the computer by means of an input device. The data and the instructions, thus received through keyboard are passed into the memory unit. The control unit directs and regulates the information and instructs the ALU to do the required calculations, by getting data from the memory unit. After processing, the results are stored in the memory unit. From the memory unit, the results are displayed by the output unit.

In microcomputer, the ALU and control unit are together contained in a microprocessor chip. Thus the microprocessor chip contains the CPU. A microprocessor is basically a CPU designed and built as a single integrated circuit. The memory is contained in memory chips (Random Access Memory chip and Read Only Memory Chip). Inside the computer, there is a special board called the motherboard. The microprocessor and the memory chips are fitted into the motherboard.

On the motherboard, there are some slots through which the various input and output devices are connected to the microprocessor and the memory chips. On the motherboard, the various components are connected to each other through sets of parallel electrical conducting lines called 'buses'. The microprocessor itself contains some special storage locations called 'registers'. Let us discuss the components of the CPU:

Arithmetic and Logic Unit:

Functionally an ALU can be divided into two segments: the arithmetic unit and the logic unit. The arithmetic unit performs arithmetic operations such as addition, subtraction, multiplication etc. The logic unit does logical comparisons such as Boolean AND, OR and NOT. All the operations are carried out on the

principle of addition. For example, division is done by repeat additions. In other words, division is nothing but repetitive complementary additions.

There are three main components of the ALU: mathematical gates, logic gates and registers. A gate is an electronic switch with several entrances but with only one exit. Data come in through the entrances and answers come out via the exit. A math gate performs basic calculations. A logic gate performs logical operations. A register is a special storage area in the CPU to hold data during the completion of these operations.

The functions/features of the ALU may be summarised as follows:

i. It always adds in order to perform the various arithmetic operations.

ii. All operations in the ALU are carried out in binary under the control of control unit. Once the processing is over, the final results are released to the output storage area from there, they proceed to the output service.

iii. The ALU is responsible for movement of data between storage and itself, in performing arithmetic and logical operations.

iv. The movement of data between the ALU and the CPU's storage area (i.e. registers) may take place several times before one processing operation is completed.

Control Unit:

It controls, supervisors and oversees all the activities of a computer and monitors the execution of any programme processed. In other words, the control unit co-ordinate and controls the activities of the different components of the computer system. It's functions are summarised as follows:

i. It coordinates the activities of the input-output, arithmetic and memory units by timing and directs the flow

of information from one unit to another.

ii. It interprets each instruction and directs the other units to perform these instructions.

iii. It supervises input of information, storing and retrieving of information

iv. It determines sequence of instruction to be executed.

v. It stores the results in the CPU memory

vi. It repeats the cycle of operations till either it is instructed to stop or the last instruction is executed.

vii. It keeps a watch over the problems such as equipment malfunction, illogical instructions or erroneous data.

viii. In order to carry out the various functions (i.e. operations) mentioned above, the central unit has built certain basic registers:

Sequence control register	:	It selects the instructions sequentially and reads it to the Instruction Register and moves to the next instruction.
Instruction register	:	It separates each instruction into two parts: Operation parts and address parts and sends them respectively to the Decoder and the Address Register.
Decoder	:	It interprets the instruction (received from the instruction register). On the basis of the interpretation, the corresponding operation (for example: DIVISION) is activated in the ALU.

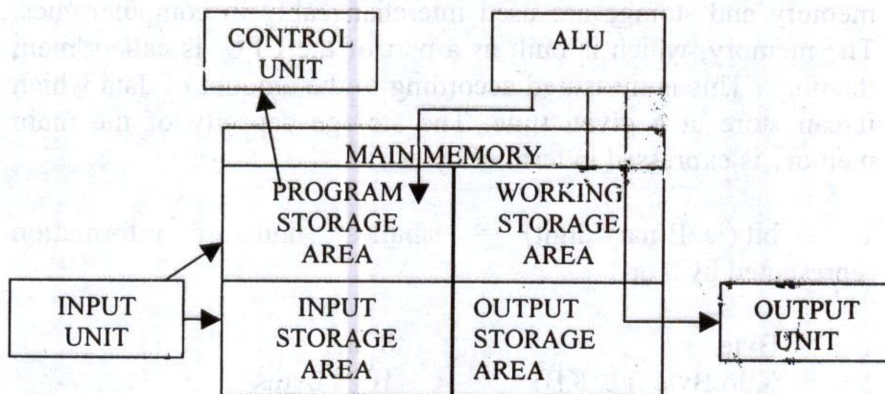
Address register : The address part of the instruction is stored in the address register we can retrieve the required data by referring to the address.

Instruction Address register : It holds the address of the next instruction

To conclude, the control unit does not perform any processing on the data. Rather its function is to maintain order and direct to flow of sequence of operations of data within the computer.

Memory unit:

All the instructions and data fed into the computer are stored in this unit. After performing certain calculations, the results are also stored in the memory. This is also known as primary storage area, working storage area, input storage area and output storage area.



Program storage area : It holds the processing instructions.

Working storage area : It is scratch pad wherein intermediate data are held while being processed.

Input storage area : It is the place where data received from the computer are held until they are processed.

Output storage area : It holds the finished results until released to the users.

These four areas do not have any physical boundaries. And also they need not exist in that order they can vary from one application to another. The actual size of each area is determined by the programmer writing the application instructions.

MEMORY

The computer system need a scratch pad for calculation and a storage area for keeping its results for further processing. This is called as 'memory'. There are two types of memory

i. Primary memory/main memory/internal memory
ii. Secondary memory/Auxillary memory/External memory.

Primary Memory/Main Memory:

Computers are so versatile in the sense that they can deal with a vast amount of data which remain in the memory. The terms memory and storage are used interchangeably in computeronics. The memory, which is built as a part of the CPU, is called 'main memory'. This is measured according to the amount of data which it can store at a given time. The storage capacity of the main memory is expressed in term of bytes.

1 bit (ie. Binary digit) = smallest unit of information represented by 0 or 1

1 Byte = 8 bits
1 Kilo Byte (i.e. KB) = 1024 bytes
1 Mega Byte (i.e. MB) = 1024 kilo bytes
1 Giga Byte (i.e. GB) = 1024 Mega bytes
1 Tera Byte (i.e. TB) = 1024 Giga bytes

The primary storage is used for tour purposes

i. To hold date (in input storage area) until they are processed

ii. To hold intermediate data untill being processed (ie in

working storage area)

iii. To hold the processing instruction (in program storage area)

iv. To hold the finished results of the processing operations (in output storage area)

Characteristic features of the main memory:

i. Primary storage is generally classified as byte oriented or **word oriented**. A byte is capable of holding a character of data. Thus, a byte oriented machine can hold data on an individual character basis. A word is a unit of memory that can contain an entire number without dividing the number into individual digits. Most computers are word-oriented.

ii. Every location in the storage has a unique address by which the contents can be identified.

iii. In so me computer system, we can increase the space in the primary storage reaction through virtual memory system. When a program reaches a logical break, the operating system software arranges to return the completed portion to the backing storage and brings the next section into the main storage. Thus, memory space can be effectively utilised.

iv. The processing capability of a computer is determined by the size of the primary storage which is measured in terms of bytes. Each location in the main memory can be viewed as a cell having its own unique address each location can hold a word or a byte.

v. If the computer machine is word oriented, the size of a word remains constant (ie fixed word length). If it is byte-oriented, it will have variable word length.

vi. A storage unit of a computer system is ranked according to the following criteria.

a) Access Time : It is the time required to locate and retrieve stored data from the storage unit in response to a program instruction. A fast access time is preferred.

b) Storage Capacity : It is the amount of data that can be stored in the storage unit.

c) Cost per bit of Storage

There are two kinds of Memory.

1. ROM (Read Only Memory)
2. RAM (Random Access Memory)

ROM (Read Only Memory)

The main memory can be classified into two type

i) Magnetic core memory and ii)Semi conductor memory

Magnetic core memory was introduced in 19[illegible] and was used till 1975. It is constructed with millions of basic elements known as 'Ferrite Cores'. It provides a reliable and fast random access storage. It though it is expensive, it is extremely useful. Here it is described only for historical reasons. There is a tendency to call the main memory as magnetic core memory, event though it is a semi-conductor memory.

All modern computer use semi-conductor memory. Semi-conductor memory consists of electronic circuits prepared on silicon chips. The electronic circuit is called a flip flop. A flip-flop is also called a storage cell. Thousands of these storage cells can be prepared on a single silicon chip. Due to this, the size of memory is very small.

PROM

PROM stands for programmable Read Only Memory. An

the name implies, it can be programmed only one by the user. It belongs to the semi-conductor family. The manufacturer initially connects all the memory locations by fuse links to logical one level. As per the data requirements of the user, each location can be programmed. Once the programming is done, no further modifications are possible. This is also a non-volatile memory.

EPROM

It stands for Erasable Programmable Read Only Memory. The contents of memory location can be erased by passing Ultra-Violet light (UV). Now the device can be reprogrammed by means of PROM programmer. Care should be taken to keep the device away from stray light. Bright sunshine can erase ERROMS. ERPROMS are used is personal computers. This type of memory is useful for design and development application. This is another non-volatile memory.

EEPROM

Electronically Erasable Programmable Read Only Memory does not require a strong source of ultraviolet to erase their contents. They can be electrically erased and reprogrammed. Once erased and reprogrammed, the contents remain fixed until next erasure. Erasure means the entire contents of the memory is erased. Though it is possible to erase a portion of the memory, it will shorten the life of the chip. Therefore, it is another non-volatile memory. EEPROMS are used to store fixed routines and library functions.

Different between RAM and ROM:

	RAM	ROM
i.	It is volatile in nature	It is non-volatile in nature
ii.	Information can be stored and retrieved at the choice of the programmer	Information stored in the memory cannot be altered (except in case of EPROM)
iii.	It is used to store immediate results etc	Permanent function like Sinx, cosx are stored.
iv.	It is expensive	It is cheap
v.	It is easy to change	It is expensive to charge

Differences between Primary Memory and Secondary Memory

	Primary Memory	Secondary Memory
i.	It is located within the CPU	It is located outside of the CPU but connected to the CPU
ii.	It is expensive	It is less expensive than the primary expensive
iii.	It has the capacity to store up to several million bits	It can hold billion it bits
iv.	Its access time is in billionths of a second	Its access time is in millionths of a second
v.	Data can be processed directly from storage	Data should be moved first to primary storage from the secondary storage for processing
vi.	Magnetic core is used as a means storing information.	Magnetic tape, magnetic of disks are used as means of storing information.

Cache Memory:

Apart from the main memory, this type of memory is available is some computers. Basically, the cache memory is the

RAM buffer, which is used to store program and data for fast access. If serves as a high speed buffer between the CPU and the primary storage. It is used as a temporary storage location to store data and instructions that are likely to be retrieved many times by the CPU during processing. This increases the processing speed. Some computers use cache to hold a block of instructions that follow the current instructions being processed.

In general, the cache memory holds portions of the program and data which are used frequently and repeatedly. The portions of program and data which are less frequently used are stored in the main memory. The remaining portion of program and data which are less frequently used are stored in the main memory. The remaining portion of program and data, which are not used frequently, are stored in the secondary storage. Thus the program and the data are stored at three levels. The CPU first consults the cache memory and when it cannot find the instruction/date it goes to the main memory. If it is not available in main memory, it will go to the secondary storage. Thus, the access time increases, when it moves from the cache memory is move expensive than the primary storage device. Therefore, if is used in small sizes.

Virtual Memory:

The computers have a main memory. As it is expensive, the amount of storage available in the main memory is limited. Therefore, the user cannot accommodate larger programs in the main memory. To execute a large program, it needs large amount of storage capacity. With insufficient storage, it is not possible to execute the program. Thus is a real and practical problem. Virtual Memory is a technique which eliminates the problem of limited storage. Under this techniques, the program is segmented into small programs called 'pages'. Most pages me on secondary storage devices. Those pages, which need processing will be kept in the main memory. Once the pages are executed, they will be transferred to the secondary storage devices. And these other pages, which require processing, will be brought to the main memory. This means pages are moved in and out of memory. Thus, from the programmers point of view, the effective size of the available primary storage may appear to be unlimited.

Secondary Storage/Auxiliary Memory:

Auxiliary memory is called External storage or secondary storage memory. When we need to hold large amount of data or mass information, we can use secondary storage services. We can transfer the data easily at any time, secondary storage services have the capacity to hold large amount of data than the main memory. These are all less expensive. Different types of storage devices are available such as Hard disk, Floppy disk, magnetic tapes etc.

Peripheral Controllers:

Peripheral controllers are the cards that are connected to the motherboard at one end to the respective peripherals at the other end. They control input to the peripherals and output from the peripherals. The common peripherals are:

i. Floppy Disk Drive Controller
ii. Hard Disk Drive Controller
iii. Display Controller Card

Floppy Disk Drive Controller:

FDDC is a card, which interacts between the motherboard and the floppy disk drive through a flat ribbon cable. The card is fixed is one of the stored into a floppy disk through floppy disk drive. Any information already stored is floppy disk can be retrieved whenever needed. The name can be deleted once not required. The floppy drive thus has been facility to read, write and delete contents in a floppy disk. The different kinds of floppy drives are 5.25", 3.25" etc. Different controller cards support different drives.

Fixed Disk (Hard Disk) Controller:

There are different types of fixed disk controller cards, depending upon the capacity of the hard disks. In certain cases, the hard disk will include SCSI (Serial Connection Serial Input). This device is meant for storing permanent data.

Cartridge Tape Drive:

Today's microcomputers do not use big magnetic tape drives. They use what are known as cartridge tape drive (CTD).

These are slightly bigger than an audio-cassette. They can store enormous amount of data. These are all requential storage devices. They are slower in read/write operations than magnetic tape but are well suited for use with the microcomputers. These tapes have to be placed inside a CTD unit for any operation to be performed on them. They are widely used to backup data from micro disks.

3.7 Review Questions

1. What is the basic principle of operation of a digital computer? Explain with a block diagram.

2. Explain how data are fed into the computer? Give various devices that are used to input data to the computer.

3. How are the printers classified? Explain them in detail

4. Explain different types of non-impact printers.

5. What are the devices that can be used as input as well as output devices?

6. What is memory? Distinguish between main memory and auxillary memory.

7. What do you mean by RAM and ROM?

8. Discuss the functions of CPU?

9. Explain VDU and Graphic Display Devices.

10. Write short notes on i)Cache memory ii) Virtual memory

11. Write a short note on peripheral controllers.

12. Explain different modern input devices used at present

13. Compare the characteristic features of Floppy Disk and Hard Disk.

14. Explain CR-ROM and WORM

15. What is memory? What are the characteristic features of memory? Explain its types.

LESSON - 4

4.1 What is software?

Software is a very widely and loosely used term to refer to various packages. In essence, any program written in any language that will work on a particular computer system can be classified as software. Thus, the software is the logical and sequential series of instructions, which are given to the computer system on the basis of which it works. In simple, software is a set of instructions (programs) given to the computer system to perform the desired task. The computer cannot do anything without software. It acts as an interface between the user and the computer.

Need for software:

In our day to day life, we have to maintain massive records for various purposes. For making decisions instantaneously on the basis of information, we have to store data and information with computer, we can make wonders in any field. We can store large amount of data and retrieve such data as and when we need for quick decision or for reference. Today computer has become a boon to the human society in all respects. For example, Let us take the case of using computers in railway stations. The manual method of making reservation has now changed to computerised method we can make advance reservations from any place for our onward and return journeys. The place at which reservation is made may differ from the place where we actually start our journey. It was not possible under manual method of reservation. In banks, trial balance, profit and loss account and balance sheet are prepared on daily basis with the help of computerised software. In short, software can be used in any area because of the following advantages.

i. As software are uses friendly. We can work conveniently.

ii. Data can be fed into the computers on daily basis through on-line/off-line methods.

iii. Data can be retrieved in any combination at any point of time.

iv. Optimum utilisation of human resources can be made.

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By using computers, man power is considerably reduced. Such human resources can be utilised for some other jobs.

4.2 Types of Software:

Software can be classified into two types:

i. System software
ii. Application software

4.2.1 System Software:

System software is a set of instructions designed to operate and control the computer system. It is generally prepared by the manufacturers of computers. It can be further classified as follows:

i. Operating System
ii. Translators
iii. Utility Programs

4.2.1.1 Operating System:

Operating system software is a software which consists of programs that manage and control the over all operations of a computer. Computers cannot run without an operating system. It acts as an interface between the user and the computer. Whenever the computer is switched on, the operating system is first loaded. Only then, we can operate the computer. It performs three functions:

i. System Management: It manages the hardware, software and data resources of the computer system during the execution of application programs.

ii. System Support : It supports the operations and management of a computer system by providing a variety of facilities.

iii. System Development: It helps the users to develop system program example language translators, programming tools etc.

Since the operating system functions in the most efficient manner, it maximises the productivity of a computer system. At the same time, it minimises the amount of a human interaction required during processing. It also helps to enter data, save and retrieve files, print or display output. Of all, it acts an interface between the user and the computer.

In simple terms, the OS performs the following function:

i. To control input/output operations
ii. To take input from the keyboard
iii. To display message on the screen
iv. To store data on external storage device
v. To send output data to the printer
vi. To control the printer

There are three types of user interfaces

i. Command drives
ii. Menu drives
iii. Graphical User Interfaces (GUI)

Present way operating systems have moved towards the graphical user interfaces. A GUI presents icons, bars, buttons, boxes and other images.

The following are same of the popular operating system:

i. DOS
ii. UNIX
iii. WINDOWS AND
iv. NETWORK

DOS:

The Disk Operating System (DOS) is the most popular operating system used in personal computers. If a computer has more than user terminal, DOS cannot be used. In computer terms, we say that DOS is not a multiuser.

In personal computers, MS-DOS (Microsoft Operating

Systems) and OS/2 (Operating System-2) are generally used.

UNIX:

Unix is the most popular multi user operating system. In the computers that have more than one user terminal, UNIX can be used.

WINDOWS:

Software, almost all the softwares are now developed on windows based manner. In this method, the user has a little work on the keyboard. The monitor shows everything in the form of pictures and one can easily choose from the options given. A hardware called mouse is used to operate the computer. The latest version of windows is WINDOWS NT and it has been developed by the Microsoft company. It is far superior to UNIX, WINDOWS 95 is an advanced OS processing.

Special features of the GUI, Multitasking, Networking, Multimedia and several other capabilities:

WINDOWS NT (New Technology) was introduced in 1993. It is a powerful multitasking. It is a multiuser OS installed in the Network server to manage LAN'S and Workstations.

NETWORK:

In recent developments, many computers can be linked to gather with a master computer (i.e. file server). Data and programs can be transferred from one computer to another. For Example, the computers in the various departments of a company can be linked to the head office. This type of connection is called Network. When the computers are connected with the file server using a network, they need an operating system to handle the network facility.

4.2.1.2 Translators:

Computers knows only machine language i.e. binary codes such as 0 and 1. Therefore any instructions to the computer must

be expressed in machine language instructions. It is very difficult to write instructions in machine language. We write instructions in high level language (which is similar to English statements). Therefore, instructions is high level language have to be translated into machine language codes.

Translators are of three types:

i. Assemblers
ii. Compilers
iii. Interpreters

Software developed for this purpose are categorised as system software.

Utility Programs:

Utility programs are system programs which provide facilities for performing some common tasks of a routine nature. They are:

* Sort Utilities
* Editors
* File Copying
* File Maintenance
* Debugging
* System Status Utilities

4.2.2 Application Software:

Application software is a software which is written for a specific application. In other words, it is a set of programs meant for a specific application. For example, programs for the preparation of pay roll, programs for inventory control etc are some of the application software. Application packages such as dbase, wordstar, Lotus 1-2-3, Clipper etc, can also be terms as application softwares. The following are various application areas of softwares.

* **Accounting** : Cashbook, bankbook, vouchers, debit and credit notes, ledger posting, trial balance and balance sheet.

* **Inventory** : Information details on stock in and stock out ordering level recording level, other control methods, stock location etc.
* **Sales System** : Price information, quotation, billing, receipts, cheque transactions etc.
* **Purchases** : All purchase activities, suppliers list etc.
* **Library System** : Books purchased, books issued, books returned, accession register, finalist, missing list etc.
* **Hospital System** : Reception, booking, billing, patient, management, inventory, doctors, consultants etc.
* **Hostel System** : Reception, Guest Management, billing etc.
* **Banking** : Inter-branch transactions, inter-bank exchange system, ATM, ALPM etc.

* Railway, airlines, ticketing system etc.

Difference between hardware and software

	Hardware	Software
i.	It is the physical components of the computer	It is a set of instructions to bring the hardware system into operation.
ii.	The design can be modified according to the capacity	This should be prepared according to the type of capacity
iii.	It understands only machine language or low level language	It is written in high level language
iv.	It works with binary codes i.e. 0s and 1s	It is represented by the high level language
v.	It consists of input unit, output unit and CPU	It is categorised as operating system, utility programs language processors application programs etc.

i. Word Processing:

The word processing package is used to generate documents in a textual form. Any work that can be done in an electronic typewriter can be done in word processor. Word processor has some additional features which are we don't have in a typewriter.

i. Changes, insertions or deletions can be made at anytime even after the entire document has been typed.

ii. Words, sentences, paragraphs or even entire chapters can be moved from one location to another.

iii. The screen that displays the text will give information about the present location in the document, margins and tabs and the keys to use for different tasks.

iv. It allows entering, editing, all formatting concurrently while printing is going on.

v. It may be set to print the text repeatedly for the required number of times.

Word star is a powerful and well-established word processor recommended by the manufacturer for use in microcomputers. It uses MS-DOS operating system.

ii. MS-WORD 97:

Business software integration has released MS-OFFICE 97 exclusively for office applications. It consists of MS-WORD (word processing) MS-EXCEL (electronic speed sheet) MS-ACCESS (Business data management, MS-POWERPOINT (business presentation) and MS-OUTLOOK (information management).

MS-WORD 97 has many advanced and additional features:

- Web tool bar is available to design web pages
- Free form pencil mode, enables us to draw/erase tables, split and merge cells etc.
- 32 different shapes, 28 types of arrows, 28 how chart diagram shapes,16 starts & banners,20 callouts
- Text can be animated with blinking background
- Various font flavors like embossed engaged, shadow, outlined text etc.
- Dialogue boxes are available to choose various options
- 18 tool bars are available

iii. dbase III Plus

It is a database management system for microcomputers. It is a comprehensive and integrated system for storing, manipulating and retrieving data on a microcomputer. It was developed by ASHTON-TATE, USA Information are stored in files called database files (dbf files). Commands used in it are English like commands. For example DISPLAY, LIST, DELETE, RECALL, EDIT etc. With the help of a simple command, it is possible to list records, print reports, replace controls of a particular field in the entire database, arrange records in ascending/descending order. It is highly useful to manage multiple database files. It can able be used on LAN (Local Area Network).

iv. LOTUS 1-2-3:

Lotus 1-2-3 in an integrated electronic spreadsheet program developed by lotus development corporation USA. Since it was developed lotus development corporation it has been named after it. It is called 1-2-3 because it has three important features

i. Spread Sheet (to compile data)

ii. Data base management (to sort, find to extract the data using database commands)

iii. Graphics facility (conversion of data into pictures)

Once the lotus program is started, the monitor displays a blank worksheet which contains 256 columns (labelled as A,B,C............AA....ZZ) and 8192 rows (numbered 1 to 8192). It is a group of row and columns. Each well is the worksheet is denoted by A1,B1,C1... and so on. We can enter data in the cells. The main menu consists of options such as worksheet range, copy, move, file print, graph data, system and quit. Which have specific function. In addition to different options under each category, financial function, mathematical functions and statical functions are available. For performing specific operation, macros are available.

It has many practical applications. The following are some of applications:

- Preparation of income statement
- Preparation of budget
- Preparation of pay bill
- Financial statements
- Sales processing and analysis etc

It is a very useful tool for performing tedious calculations.

4.4 Programming Languages:

A set of sequentially arranged industries instructions used to tell the computer what to do is called 'program'. Working out a correct sequence of instructions is called 'programming'. Computer being an electronic machine, understands only electrical circuitry. It does not understand any of our languages that are used in our daily life. The computer can understand instructions only is binary codes. It is very difficult to write the programs in binary codes. Hence, languages have been developed for the computer machine, to specify the instructions in binary codes with the help of instructions.

The programming in which programs are written are called programming languages. These languages can be classified as under.

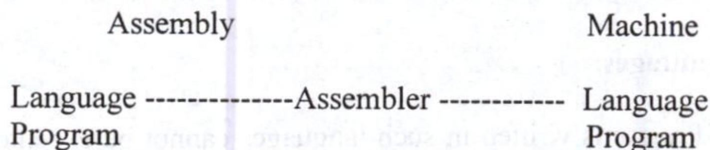
i. Machine Language
ii. Assembly Language and
iii. High level Language

4.4.1 Machine Language:

The machine language is the earliest language developed for the computer machine. The set of instructions written in a machine language is known as machine language program. It is coded with a string of 0s and 1s. Since it uses 0s and 1s, it is called binary language. The computer understands the machine language directly. Writing a program in machine language is very tedious process. Different codes are used for each instruction. The rules of the machine language differ from one computer to another. Hence writing in machine language is a difficult task.

4.4.2 Assembly Language:

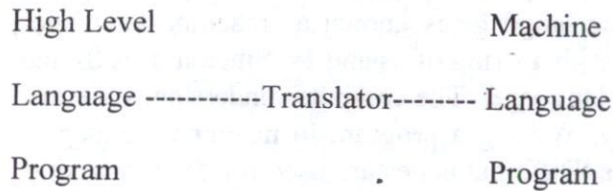
Since writing instructions in a machine language is difficult, assembly language was developed using mnemonic codes (symbolic notation). Symbolic notations are used to represent the language of the machine language. For Example, MOV is a mnemonic field. It moves the contents in the register, the assembly language has to be translated into the machine language. Translation is done with the help of an assembler.



4.4.3 High Level Language:

The programmer, who writes programs using machine language or assembly language, must have a sound knowledge of hardware and should remember many operation codes. So programming is slow and a time consuming process. To overcome

this high level language have been developed. High level language are also called 'program oriented Languages'. A high level language resembles ordinary English statements. Any program written in a high level language can be run on different computers with or without modifications. The programmer need not know about the hardware details. Since the computer understands only machine language, any program written in a high level language has to be compulsorily translated into machine language before it is executed. Translation from high level language program into machine language program is done with the help of either interpreter" or "compiler".



Advantages and disadvantages of programming Language.

i. Operation codes used in machine language are replaced by mnemonics which are easier to remember.

ii. It is not required to keep the track of memory locations

iii. Insertion and deletion are quite easy.

iv. Recursion of complete program is easy

v. Few instructions are enough to achieve the result

Disadvantages:

i. Programs written in such languages cannot be executed on small sized computers

ii. Due to complex nature of language, it will take long time to code.

iii. It lacks portability programs (i.e. program run on one cannot be run on another computer)

Advantages and disadvantages of High Level Language

Advantages:

i. Since it is procedure oriented, it is easy to write programs

ii. Correction and testing of program is easy.

iii. It does not require the knowledge of internal structure of the computer

iv. Program written for one computer may be used on another computer (i.e. portable)

v. Modifications in the program can be easily made

Disadvantages:

i. Since it is not machine oriented, more machine code instructions have been provided. It requires large memory space and more time to run the program.

ii. It runs slower due to portability and generality of statements

iii. The compiler, which is needed to translate the source program, written in high level language, into the machine code, occupies enough of memory space. Therefore, memory space to store the source program is greatly reduced.

Classification of High Level Language:

High Level Language may be furtner sub divided into three types:

i. Produce oriented language
ii. Problem oriented language
iii. Interactive programming language

some of the popular high level language are :

BASIC:

BASIC is an acronym for Beginner's All Purpose Symbolic Instruction Code. It was developed in 1965. It is an user friendly language. It is developed specially for students and research scholar.

C:

C was developed at Bell laboratories in 1972. It combines the features of high level, machine and assembly languages. It is a machine independent. Now it is used for developing system software and application softwares.

COBOL:

COBOL stands for Common Business Oriented Language. It was developed in 1958 by the US department of defence. It is highly self-documenting. It has powerful data oraganisation and file handling capabilities. It is widely used for data processing jobs.

C++

An offshoot of C is C++. It is supported by Object Oriented Programming Concepts (OOP). It was powerful task and graphic capabilities.

JAVA:

It is used to develop applets in Internet Applications.

High Level languages are procedural languages ie the user has to specify the steps to achieve the desired results. For example to calculate simple interest, the programmer has to specify the following steps:

Read data for principal, no of years and rate of interest to simply specify what the output should be. He need not specify how data are to be manipulated.

The following table shows how programming language have evolved during different generations:

Generation	Programming Language
First Generation	Machine Language
Second Generation	Assembly Language
Third Generation	High Level Language
Fourth Generation	Non-Procedural, Conversational Language
Fifth Generation	Artificial Intelligence Technique

Comparison of Languages:

High Level	Assembly Language	Machine
Language		Language
It uses words which resemble English words	It uses mnemonic codes	It uses binary digits 0 and 1
Easy to learn and write programs	Easy to learn but difficult to write programs	Difficult to learn & write programs
It needs translation into machine code	It needs translation into machine code	It does not require any translation
Translation is done by compiler/ interpreter	Translation is done using assembler	No need for translation.
More execution time	Less execution time	very less execution
Requires more memory space	Requires less memory space	Requires less memory space
Programmer need not know about the details computer	Programmer should know the details	Programmer should know the details of the computer

Different languages can be used	Only one assembly language for one computer	Only one machine code for one computer
To write instructions, it requires less time	It is time consuming	It is tedious and time consuming
useful for developing application programs	useful for developing system software	useful for developing programs

4.5 Languages Processor (i.e. Translator):

A language processor translates instructions written in assembly or high level languages into machine level instructions (i.e. in binary code). The program written in assembly or high level language is called a source code program. The program, thus converted by the language processor into machine code, are called, object code program.

Procedure Oriented Language:

The language is called procedure oriented in the sense that the user has to specify the steps to achieve the desired results. Procedure oriented languages are useful for some special applications. For example, COBOL is a procedure-oriented language, which is used for business applications only. The other examples are FORTRAN AND PL/1.

Program oriented language:

It allows the user to fours on what results are desired rather than on the individual steps to get those results. The best example of program oriented language is RAG (Report Program Generator).

Interactive Programming Language:

It allows the user to interact with the conversational fashion. These are used especially in computer aided designing (CAD) and computer Aided Manufactures (CAM). BASIC, PASCAL and examples interactive languages.

High level languages are sometimes classified as general purpose and special purpose languages. General purpose languages are suitable for type of application where as special purpose language are used only for some special applications (COBOL and LISP) there are two types of language processors available

i. Assembler (which convert assembly language code to machine code)

ii. Compilers (which convert high level language code to machine code)

Another type of language translator is 'interpreter'. It does not produce any object code. It directly executes the program line by line.

4.5.1 Assemblers:

A program written in assembly language cannot be run on a computer system directly. It has to be translated into machine code. This can be achieved with the help of assembler. It converts the instruction code mnemonic code etc are some of the examples of assembler.

4.5.2 Compilers:

A compiler is a system software. It translate a high level language program into a machine language program. It translate whole of the program into machine language and executes directly. Compilers have been written for many languages such as FORTRAN, C, PASCAL and the like. Examples of compiler are TURBO PASCAL, MICROSOFT, C QUICK C, TURBO PROLOG etc.

4.5.3 Interpreter:

An interpreter is a translator that translates a high-level language program into machine language program. Each instruction/statement is taken one by one, converted to machine language and then executed. At a time, it translates and executes one instruction/one statement. Unlike compilers, entire program is

not translated and executed. BASIC i.e. available in the interpreters are GWBASIC, INTRODUCING C, BASIC etc. Compilers such as QUICK BASIC, TURBO BASIC may be used to run BASIC programs. As such, basic may be interpreter based or compiler based.

Difference between a compiler and an interpreter:

	Compiler	Interpreter
i.	It translates the whole program at a time	It translates and executes each line of a program at a time
ii.	It detects all the errors in the program	It detects only a single error at a time
iii.	It stores the program automatically into memory	It stores the program into memory on receiving the instruction from the programmer.
iv.	It takes less execution time	It takes more execution time
v.	It requires more memory	It requires less memory

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4.6 REVIEW QUESTIONS

1. What do you mean by software? Explain different types of softwares.

2. What do you mean by hardware and software? Bring out the differences between hardware and software.

3. Explain different operating systems in use.

4. What do you mean by programming languages? Explain them briefly.

5. Programming in high level languages is easy - justify

6. Compare machine language, assemblv language and high level languages.

7. Explain the necessity of interpreters and compilers and state the differences between them

8. Discuss in detail about 'language processors'

9. State the disadvantages and advantages of programming languages.

10. Explain some popular application packages

11. What do you mean by operating system? Explain its functions.

Lesson - 5

5.1 Computerisation in Banks.

5.2 Stand alone system.

5.3 Local Area Network.

5.4 Automated Teller Machines.

5.5 EFT

5.6 MICR

5.7 OCR

5.8 Inter-branch Reconciliations.

5.9 Home Banking.

5.10 Internet.

5.11 Y2k problem.

5.12 Virtual Banking

5.13 Security Aspects of Mechanisation.

5.14 Security Considerations.

5.1 Computerisation in Banks:

With the nationalisaton of banks in 1969, the banks went through a period for rapid expansion both in terms of number of branches and in terms of volume of business. There has been a tremendous increase in the distribution of branches and the size of the deposits and advances. At the same time, the banks have not paid much attention to modernisation. The technology and the system of operation have not been changed.

It the 1960's, only a few of the Indian banks introduced computerisation at the macro level by establishing Electronic Data Processing Departments (EDP) with mainframe computers which were used for high of volume activities like reconciliation of inter branch transactions. During the seventies, computers were used to deal with foreign exchange business. Only in 1980, the banks felt the need for large-scale computerisation to handle the increasing volume of business.

In the early 1980's, the Indian banks association negotiated with the recognised employees union regarding computerisation. But, most of the unions opposed the introduction of computers in banks. Finally unions came to the view that computerisation was essential for the survival of banks.

In 1983, the Reserve Bank of India appointed a committee under the chairmanship of Shri. C. Rangarajan, Deputy Governor.

i. to identify the areas which require computerisation.
ii. to identify the extent of computerisation.
iii. to suggest the various measures for bringing out successful implementation of computerisation at various levels.
iv. to make other suggestions incidental to the subject of mechanisation of banks.

The report was submitted to the RBI for necessary implementation. But unfortunately, the progress on computerisation was unsatisfactory and the targets set out in the reports would not be achieved due to several procedural and organisational problems in banks. In the first phase of computerisation spanning the five years ending 1989, the progress

achieved by the banks in the area of computerisation is as follows:

ALPMS installed in branch level	:	4776
Mini computers installed at the Regional/Zonal office level	:	233
Programmers/systems personnel trained	:	2000
Data entry terminal operators	:	12000
MICR clearing centres	:	4
Computerised clearing centres	:	9

(SOURCE: RBI MONTHLY BULLETIN, APRIL 1999)

Against the backdrop, the RBI constituted another committee on "Computerisation in banks." in 1989 under the chairmanship of Dr.C.Rangarajan, the then Deputy governor. The committee submitted its report in 1989. The salient features of the report are as follows.

i. The main purpose of computerisation is to bring about improvement in customer service house-keeping, decision making and productivity/profitability.

ii. To computerise fully about 2000- 2500 larger branches which have a daily workload of 750 vouchers or more

iii. Three suggestions were suggested for computerisation

SUGGESTION:-1.

- installation of super-micro or mini or super -mini computers along with on-line terminals at all counters of the identified branches.
- connecting these branches over data communication lines with a bigger computer.
- each bank to have a separate host (which serves as a backup)
- connecting banks through BANKNET/Public Data Network

SUGGESTION:2

- installation of PC's at various counter connected through LAN.

- Branches will be connected through BANKNET with each other and to the RBI

- computer system of one branch can serve as the back up for another branch

SUGGESTION:3

- using telecom lines within the city and between 30 cities.

- installation of on-line terminals/PC'S at the convenience of each branch

- branches are hooked onto one central system for that bank

iv. To introduce ATMS (to start with in Mumbai at strategic locations such an airport, railway station etc.

v. Bank should increasingly use ancillary equipments such as word processors, copying machines, facsimile machines, audio-visual aids for conference etc.

At the initial stage a little progress had been noticed. Though branch computerisation targets have not been met at all, branches have started installing ALPM for front office computerisation in the branches. Networking takes place at various levels in a phased manner. Installation of ATMS, signature storage and retrieval, credit cards, office automation Šand training of personnel are in progress. As such, the implementation of the recommendations by the banks has gathered momentum. The issue is no longer whether technology is needed or not. The real issue is how much, What type and how quickly.

Need for Computerisation:

i. **Global competition:**

Banking is essentially information oriented, When banks deal with crores and crores of rupees, which are several times greater than their assets in global market, speed and accuracy are essential success.

ii. **Customer Demands and Service:**

With the pressure of time and mobility, and with the growing competition between banks, customer demands have become more sophisticated.

The customer not only wants quick prompt service at the counter, but also wants sophisticated facilities such as ATM, EFT etc.,

iii. **Control and Communication:**

When organisation grows, the level of information flow will also increase. If proper control is exercised, information flow will be highly efficient. With the rapid expansion of branch network the need for an efficient system for flow of information from branch to zonal office to Head office is felt.

iv. **Competitive environment:**

In the context of keen competitive environment, the technology with which the informations are processed, assumes greater role. A bank, which has poor information system can never survive in the competitive world.

v. **Volume of work:**

The banking industry has reached a stage where the volume of business cannot be handled by the human force. For example in reconciling inter-branch transactions between say 2000 branches, the human force cannot achieve the speed and accuracy as achieved by the computers.

vi. **Cost of operation:**

If a bank wishes to achieve and improve profitability, it has to mechanise the bank operations.

Today advanced countries entirely depend on computers for processing all types of banking transactions replacing manual processing. In India with the financial sector reforms, the Indian financial market is becoming dynamic driven by the demand of users of financial services. With the entry of new banks the competition has been intensified against this background. The use of computers and allied technology by banks has become inevitable to achieve satisfactory level of customer service.

Advantages of computerisation in banks:

Benefits that are derived from computerisation are discussed from the point of view of organisation and from the point of view of the bank customers. From the point of view of the bank customers:

- prompt delivery of statement of accounts.
- correct and prompt calculation and application of interest
- prompt execution of standing instructions.
- information about balances standing in the accounts.
- avoidance of wrong postings in the ledger.
- checking of stop payments.
- easy transfer of funds.

From the point of view of the organisation

- employees are relieved from monotonous and routine work.
- storage of high volume of data.
- faster submission of reports /statistics.
- better working conditions.
- effective credit monitoring.
- better customer service.
- timely decision making.

- creating some degree of uniformity in the data submission by the branches.
- inter branch reconciliation.
- staff data can be compiled.
- pay roll preparation.
- data base in respect of customer profile.

Status of computerisation of Banks in India:
(source: RBI monthly Bulletin, April 1999 pp 553-555)

Let us discuss the current status of computerisation of banks in India.

Number of computerised bank branches:

As on 30-9-1998, out of 45439 branches of the public sector banks, as many as 3668 branches (8%) have been fully computerised with more than 65000 computer nodes/pcs. A total of 6961 branches (15%) have been partially computerised with ALPM, electronic accounting machines and personal computers. Of the 336 service branches, 149 have been fully computerised and 166 have been partially computeised.

ATM:

The public sector banks have installed 194 ATMS all over the country and issued 8.5 lakh credit cards and 32000 debit cards.

SWIFT:

For international interconnectivity of computers, 568 branches have been connected to the SWIFT. Local area network of branches has been established at 571 branch locations using internal captive networks while 148 branches are on the RBINET.

INFINET:

To consolidate the existing payment systems
To develop technologically advanced modes of payment
To integrate different payment and settlement systems into an efficient integrated system

A computer based network has been established. This wide area satellite based network, called the Indian Financial Network (INFINET) aims at connecting computers at branches of banks. 479 branches at commercially important cities are to be connected to the INFINET in the first phase and in the second phase it will cover nearly 5000 branches.

MICR:

Apart from the four metro centres, 26 centres have been identified for implementing MICR solution. The implementation position is shown as follows:

Number of centres identified	26
Number of centres where MICR solution has been implemented	10
Number of centres where implementation is at an advanced stage	2
Number of centres where follow-up is being gone	14

5.2 Stand Alone System:

When a microcomputer is used by an user himself it is called standalone computer that is, hard disk, data, printers etc, are engaged by only one user at a time, without allowing others simultaneously to share the data and devices. This environment is known as "Single User Environment". The single user environments are characterised the presence of microcomputers of all varieties. They are termed as "Standalone Computers"

ALPM (Advanced Ledger Posting Machine):

The stand-alone computers installed in the front-office of the Indian banks are also called 'ALPMS'. These are essentially personal computers with winchester disk for data storage. The main function is to maintain the individual ledger accounts of customers of the branch. The only transactions are entered and the accounts updated. The accounts are updated in batch processing mode or on-line depending on the branch. The ALPM helps in reading the enormous work of the banking staff such as totalling of

accounts, ledger posting, ledger tallying etc. If it were done by the bank staff manually, it would require 7-8 days every month just for totalling and balancing of ledgers.

Applications:

As per the settlement between the IBA and the unions made on 29-3-1987, the ALPMs will have the following applications:

i. Current Accounts including over drafts;

ii. Savings bank Accounts;

iii. Other Deposit Accounts;

iv. General Ledger Accounts;

v. Cash-credit and other Loan Accounts;

vi. Salary and payroll.

The work-load should not exceed 2200 accounts in the case of savings-bank accounts and 400 vouchers per day in the case of other applications for each machine.

Operational Features of the ALPM:

i. Uniqueness of the account number is checked at the time of opening

ii. The file contains all the particulars of the account, like name, address, mode of operation etc.

iii. At the time of operating the account, the main particulars of the account are displayed on the screen.

iv. Issue of cheque books are recorded.

v. In the case of withdrawals, cheque numbers are verified cheque books issued.

vi. Stopped cheques are verified and stoppen.

vii. Stale cheques not paid.

viii. Standing Instructions printed out on due dates.

ix. Pending standing Instructions printed out.

x. Automatic printing of advices to customers.

xi. Checking of validity of cheques.

xii. Withdrawals checked for balance in the account.

xiii. Tracking of uncleared cheques and withdrawals against such cheques under supervisor's authority

xiv. Withdrawals below minimum balance not permitted.

xv. Withdrawals above the limit permitted only under authority.

xvi. Calculation of products and interests.

xvii. Printing of statements of Accounts.

xviii. Printing of transactions in chronological order daily.

xix. Daily print-outs of specially authorised transactions.

xx. Sectional day-books with separate columns for cash, clearing and transfer.

xxi. Daily balances in all the accounts.

xxii. Total of balances in the accounts compared with General Ledger.

Benefits of ALPM:

1. **Improvements in customer service:**

   i Prompt delivery of statements of Accounts;
   ii. Correct and prompt calculation and application of interest;
   iii. Prompt despatch of debit/credit advices;
   iv. Prompt execution of standing Instructions;
   v. Information about balances given quickly;
   vi. Avoidance of wrong postings in the ledgers;

2. **Improvement in House-Keeping:**

   i. Error-free balancing of accounts;
   ii. Checking of stop payments;
   iii. Execution of standing Instructions;
   iv. Calculation of correct product and interest;
   v. Error-free posting of ledgers.

3. Exceptional transactions can be listed out at the end of the day for verifications.

4. Bank employees are relieved from monotonous and routine work. They can devote their time for business promotion and customer service.

5. Submission of report is faster and more accurate.

Drawbacks:

i. There is a restriction on the number of transactions to be handled by the ALPM. This restricts productivity of the banks.

ii. As day books cannot be maintained with the ALPMs, there is a wide gap between on-line processing and house-keeping.

iii. The customer has to go to only their particular counter with the ALPM, which maintains his accounts. As such, on-line enquiry is not possible.

5.3 Local Area Network:

Network is defined as a set of communication links for inter-connecting a collection of terminals, computers, telephones, printers or other types of data communicating and data handling devices.

When two or more personal computers (ie. microcomputers) are connected to a master computer (called file server), it is called a network.

When the volume of information grows in any organisation, information dissemination will become more significant. Networking acts as a means to exchange information and share resources involved. A network can link people through computers related equipments and other devices using media such as telephone cables, satellites links etc, for the purpose of information exchange and resources sharing. In the banking field also, information sharing takes place through networking.

Networks are classified into four types on the basis of geographical area.

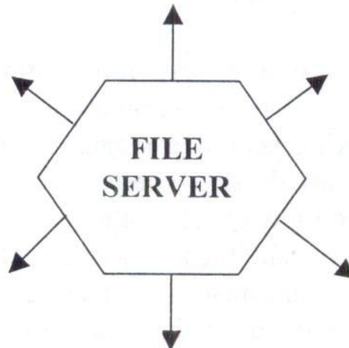
Local Area Network(LAN)	A private Network within a range of 10 kile meters owned and controlled by a single organisation.
Metropolitan Area Network	A public or private network used to (MAN) connect various locations including subrubs in a metropolitan city.
Wide Area Network(WAN)	A public network connecting different citites and towns mostly through telephone links.
Very Wide Area Network (VWAN)	A public network connecting different countries.

LAN is a system of inter-connection of personal computers and associated devices which allows exchange of information

within a limited area. In other words, LAN is also a network TREE, MESH, HYBRID), only three types are discussed below:

Star Topology:

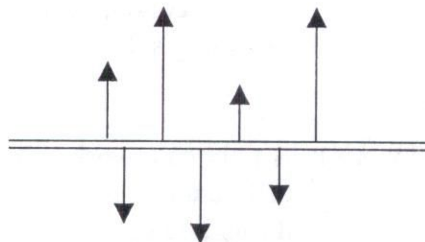
This topology is characterised by the presence of a central computer (i.e., file server). Nodes are connected to the file server through devices known as hubs. All communication in the network has to pass through the central computer



STAR NETWORK

Bus Topology:

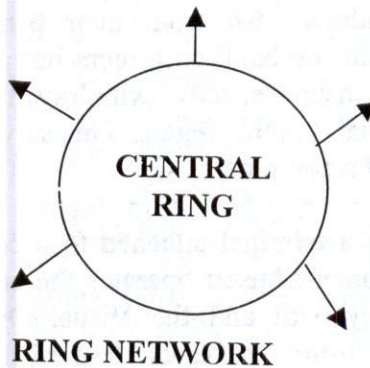
In the bus topology, there is a main trunk, to which sub-trunks are connected. Nodes are connected to the trunks through separate cables. Cone of the computers in the trunk functions as file server.



BUS NETWORK

Ring Topology:

In ring topology, there is a central ring to which nodes are connected. Generally workstations are connected through a Main Access Unit.



RING NETWORK

LAN-Hardware:

LAN is a computing environment which is implemented is small geographical area we can see a LAN installed in an office or a factory site. The major hardware components used in a LAN are discussed below:

File Server:

This is the central computer responsible for managing the complete network and hosts the Netware operating system and all other application softwares. Since its main function is to harbor all the files in a system consisting of programs and data and make then available to each of the nodes/workstations, it is named as file server.

Nodes/Workstations:

These are the computers connected to the network file server through an appropriate cabling system. These work under the control of the file server. These workstations are the user tools through which users gain access to the network resources.

The other devices such as network interface card, cables, printers, hubs, router/bridge, gateway data conversion devices and other data handling devices are not discussed here.

5.4 Automated Teller Machine (ATM):

The most important basic banking service rendered by any bank is cash withdrawal. Bank customers have to wait in a long

queue to withdraw cash from their bank accounts. It causes inconvenience to the bank customers but also it affects image of the bank. To ensure speedy withdrawals and to remove the customer complaint in this regard. This service has been automated with the help of a computer.

ATM is a terminal attached to a computer for dispensing cash. The customer himself operates the computer (of the bank) through the keyboard and the Visual Display Unit (VDU) to withdraw cash from the banks. It performs a number of other function also. It accepts deposits, points statements of accounts, issues cheque books and displays balances. Normally it dispenses currency notes of specified denomination. It specifies maximum amount per withdrawal as the machine has the limited capacity to hold cash. (Indian Banks allow a maximum of Rs.3000 and Foreign bank upto Rs.10000)

A Key element to interact with the ATMS is the magnetic stripe card. The card contains various important details about the customer such as name of the customer, account number, branch where he has an account, personal identification Number (PIN) etc. With this card, a customer can transact with the ATMS, without any personal intervention with the bank personnel. Thus ATM is a sophisticated computer terminal which makes possible for a customer transact without the personal interaction with the bank personnel. ATM provides round the clock banking service of specified nature besides during the banking hours.

Functions of ATM:

ATM network service is a sophisticated technology which is designed for the following functions:

i. Withdraw cash (after debiting his/her account through network)

ii. Carry out certain functions like balance enquiry, print mini statements recording last six transactions and/or inform balance in the account.

iii. Register request for cheque book. There is also provision to

request for detailed statement of account. However,this facility is presently not available. As and when the same is available it will be made known.

iv. Deposit cash/ cheque (presently this facility is not being made available in our bank).

v. Change Personal Identification Numbers (PIN)

Features of ATM

ATM have the following features:

Feature		Purpose
i. Magnetic Card Reader	-	Through which the machine is able to recognise the customer
ii. Recessed Key Pad	-	For the customer to key in his identification (PIN)
iii. Video Screen with key on either side	-	To enable the customer have a dialogue with ATM
iv. Currency Dispense	-	To dispense Currency notes
v. Depository	-	To accept cash and/or cheque Deposits in envelopes
vi. Printer	-	i. To provide customer with a record of the transactions ii. To record all the transactions effected by card-holder iii. Generate various reports

Benefits:

A. Benefits to customer:

i Convenience:

ATM makes it possible for cardholders to avail round the clock banking services from any of the ATM terminals installed

by the Bank, thus avoiding the hassles of Business hour rush or bank holidays.

ii Privacy:

Customers are given a sense of privacy

iii. Safe Identify:

The card holder is identified by means of PIN provided. No need for checking of signature or authentication by bank staff permit transactions.

iv. Security:

Customer can rely on the bank for cash at any time to meet unforeseen emergencies, even away from his/her place.

v. Pride:

Since ATM card is a status symbol, cardholder derives a sense of pride.

B. Benefits to Bank:

i. Relief from the pressure of peak period time.

ii. Quick service to ATM card holders.

iii. Elimination of errors in transaction handling.

iv. Existing customers are retained & new customers are induced to have account with us.

v. With increase in customer convenience, our market penetration increases.

vi. ATM network is an alternative to extended Business Hours at any location where ATM's are installed.

vii. With proper marketing, progressive image of Bank gets highlighted.

HOW TO OPERATE:

The following are the guidelines to be followed by the ATM users, while operating ATMS:

i. Insert the card through a special card reader fixed on the door panel. There will be two signal light indicators: one for saffron and one for green. If the card is accepted, the green signal will glow and you can push the door to enter the ATM lobby.

ii Insert the card in the card insert slot

iii. After having ensured that the card enters through the slot, enter your PIN within 15 seconds. Immediately the screen (the main menu displays.

* withdrawal
* cheque book request
* statement request
* balance enquiry

iv. Select the appropriate button. If you choose to withdraw using operational keys you can enter the amount which you like to withdraw. On hearing beep sound, you can take cash from the withdrawal slot.

v. Again the screen displays the following message:

your transaction is complete, would
you like any other transaction?
press if yes
press if no

vi. If you press yes, you will go back to the main menu. You can exercise your option and carry out other transaction.

vii. If you press no, you can collect your ATM card and receipt.

(* the above guidelines taken from Canara bank ATM card user guide)

ATM network:

ATM network service is a sophisticated technology based service offered by banks. Besides usage of the ATM card at the card issuing branch, the network will enable a cardholder to use the card at any one of the ATM terminals in the network system.

The Indian Bank Association (IBA) has introduced Shared payments network system (SPNS) in Mumbai. The SPNS inter-connects a large number of ATMs established by the number of banks to a central hub; this benefits the customer by allowing him to use/access ATMS situated in any part of the city, irrespective of whether he has an account in that bank or not. The Electronic Funds Transfer (EFT) system uses electronic means to transfer amounts from one bank account to another bank account directly without documents or any human interferences. EFT eliminates problems of delay, loss of interest and dishonoured cheques. EFF has made the SPNS/ATMS network possible. The SPNS symbolises the use of technology for the direct improvement of customer services. SPNS makes the concept of 24hour banking anywhere at any time banking more customer oriented. The SPNS is being extended to other metropolitan cities.

(Souce: The Journal of the Indian Institute of Bankers, vol.68, No.3, July-Sep 1997,p.107)

ATMS Abroad:

British banks, Barclays Bank and Lloyds Bank, introduced cash points in the U.K for the automatic dispensing of cash for account holders in 1974. Since then, the technology has changed little and also it has gained tremendous popularity in many parts of the world including USA, Europe and Japan. In the United States, ATMS are used not just for banking transactions. They distribute postage stamps, bus tickets train passes etc.

ATMS in India:

In September 1988, the RBI set up a committee under the chairmanship of Dr. Rangarajan, Deputy Governor to draw up a perspective plan of computerisation for banking industry. The

committee in 1989 suggested guidelines for the installation of ATMS in India. The public sector banks have so far installed 194 ATMS all over the country and they have issued over 8.5 lakh credit cards and over 32000 debit cards (source: RBI Bulletin, April 1999, P.554)

A few banks either singly or together have put up ATMS within the branch premises. These are essentially stand-alone machines catering to the account-holders at that branch or the branches in that city.

Problems:

i. **Licensing Policy:** According to the RBI policy setting up an ATM outside branch premises would amount to opening of a branch and would require to obtain a license from RBI.

ii. **Legal problems:** If ATMS are to be fully accepted the Negotiable Instruments Acts and other acts will have to be amended to take care of revised procedures.

iii. **Computerisation:** ATMS have to be backed up with computerisation of branch operations and networking of branches and this is in the initial stage.

iv. **Cost:** The initial costs of hardware and software are too high.

v. **Depersonalisation:** Customers even today feel Comfortable dealing with people rather than with machines future.

5.5 Electronic Funds Transfer:

It is common to use cash for our dealings. In certain cases, we are using cheques to settle our dues. When the payer and the payee at different places, the cheque has to be transported physically. And then, it is encashed by the payee. Instead of transferring the cheque physically, the details of the transaction is completed.

ATM:

ATM, as one of the devices, is used to transfer funds from one account to another. A customer, after entering his identification number, can electronically write a cheque (which will debit his account) and transfer the amount to the payee in account (which will credit his account). Thus, the computer attached to the ATM carries out the instruction of the customers. This saves enormous amount of labour, time and the strain of physical transfer. If an ATM is located in a supermarket, we can use it for transfer of funds we can operate it at any time even out of banking hours. The physical presence is not required in the bank premises during banking hours.

Banknet:

BANKNET is started to be the first nation-wide communication network for Indian banks. The RBI, 26 public sector banks, Indian banks association and discount to finance house of India have joined the network. The BANKNET is used to among the members for the network based reporting of inter-city clearing and transmission of credit advice to banks, It helps to control the cheque business, in introducing automated clearing facilities and funds transfer.

Banknet applications:

BANKNET offers numerous applications for commercial banks.

i. **Electronic funds transfer:** Customers can remit funds immediately to any branch in the network, transfer funds between account etc.,

ii. Quick settlement of inter-bank funds transfer.

iii. Improvements in payment system by facilitating automated clearing services thus providing faster credit to the customer.

iv. Maintenance of database of common interest.

v. Foreign exchange transactions such as sale or purchase of foreign currencies, foreign currency non-resident accounts

vi. Data transmission between RBI and commercial banks.

vii. Access to SWIFT international network from different centres in the country.

viii. Electronic mail system.

Point of sale (POS) system:

A POS is an electronic system installed at a retail establishment. It eliminates the need for the customer to pay cash at the retailer's shop. The customer presents a cheque at the counter. The clerk enter the account number and the amount of cheque into the terminal. A message is sent to the authorising centre where the cheque is verified. The message back to the terminal telling the clerk whether or not to accept to cheque.

SWIFT:

The term "SWIFT" is the abbreviation for society for Worldwide Inter-Bank Financial Telecommunication. In may 1973, 239 major international banks from 15 countries formed SWIFT as a co operative society, for the collective benefits of its members. Its headquarters is situated in Brussels, Belgium. Members of SWIFT are now spread worldwide. It is a network of computers communicating authenticated financial information in standard formats. The infrastructure is the computers located around the world Interconnected by high-speed data lines. SWIFT assumes full liability and responsibility for completeness accuracy and timely delivery of transaction instruction.

Live operations commenced from 9th may 1977. The user base was later enlarged and its services are now available to non-bank financial institution like dealers in securities brokers etc. In order to cater to the growth in message traffic and technological obsolesences, SWIFT was upgraded in the 1980 and this version, called SWIFT II is implemented on a country-by-country basis.

Banks in India are now being hooked to SWIFT II what does SWIFT offer?

i. It provides a highly cost effective and sophisticated message transmission service for standardised information with full accountability, reliability and security.

ii. It also includes additional features like format checking delivery confirmation report on undelivered messages, retrieval, broadcast facility etc.

iii. It serves all financial institutions and a selected range of other users.

iv. A multi level combination of physical, technical and procedural security ensures that the network is free from intrusion. No fraudulent message can enter the system nor can any message be modified during processing.

v. As an additional security measure, all information travelling through the system is encrypted on SWIFT global network.

vi. The network is available 24hours a day, seven days a week.

vii. All messages are delivered within normal business hours, irrespective of geographical destination.

viii. The system ensures against loss or mutilation against transmission.

ix. The network is modular in structure which permits expansion in future without disturbing existing users.

That is, various network functions are separated into distinct hierarchical levels with each level controlled by a particular computer or series of computer. Network management and access security are controlled by one computer, while message processing, routing and safe storage are handled by other computers. Message input processing and output queuing are handled by network of Regional processors (RPS) located in user countries.

x. SWIFT computers are linked by high-speed global communications network which permits constant communication with each other.

xi. All computers have at least one stand by processor which provides hardware back up.

xii. All data transmission paths in the network are duplicated to ensure continued service.

Advantages of SWIFT:

The following are the advantages of SWIFT:

i) less transmission cost compared to telex

ii) High speed and less time

iii) accuracy on account of standard formats

iv) facility of in built checking and authentication.

At present, over 1.5 million messages are handled per day. There are 34 Indian banks who are members of SWIFT. Apart from yearly subscription members have to pay registration fees of Rs.7lakhs at the time of joining the society (conversational data collected from the staff Training college, Canara Bank, Madurai-20 in may 1999.)

The normal messages that are exchanged between members in standard formats are categorised under the following heads:-

i) Customer transfer
ii) bank transfer
iii) loans and deposits
iv) collection
v) securities
vi) precise metals and syndication
vii) documentary credits and guarantees
viii) travellers cheques
x) customer status

E-MAIL (ELECTRONIC MAIL):

It is a means of exchanging information electronically either within an office or between remote locations via linked devices such as facsimile, teletypewriters, computers or other electronic devices. The facility of E-mail would enable remitters especially NRI remitters, to transfer funds directly to their accounts without any manual intervention. Nearly all banks are connected to E-mail since it is one of the cheapest methods of transmitting message information or data quickly and effectively.

Electronic mail is of various types. There are systems run within an organization to handle only internal mail. There are also mailbox bureaus a subscriber rents a mailbox and is then able to send to receive messages from any other subscriber. The system operates over telephone lines and the subscriber required a MODEM as well as a terminal. A message addressed to someone normally sits in the mailbox until the addressee choose to check it out. There are mailbox systems which use telecom and satellite facilities to send messages world-wide.

Advantages of Electronic Mail:

i) It is faster than the ordinary mail/telegraph service.

ii) The messages are saved till the addressee is ready to read it no compulsion that he would read the message the moment it arrives. Unlike a telephone which demands an immediate response, it allows the person to decide when he wants to deal with the message.

iii) The system is designed to tell the user that there is a message waiting for him: either by a bleep or by flashing a message on the screen; or it may let the user know it the next time he tries to use the system.

iv) It is possible to send multiple copies to a number of receivers.

v) Information from one message can be extracted and build into another document.

vi) All letters etc., transmitted can be retained on the system and filed electronically for retrieval when required.

vii) The recipient can take a hard copy when required.

viii) The system ensures that messages are correctly routed and that they reach their destination.

ix) There are no interruptions during transmission unlike the telephone.

x) Communication with people in remote areas is easy.

xi) People in different zones can communicate easily.

xii) Normally such messages are brief

Functions of E-mail:

Though it can perform a number of functions, three functions are important:-

i) Message Distribution Services:

As pointed out earlier, the receiver can have the message stored and attend it at his convenience. Some Electronic Mail packages handle-spoken messages. These are called "Voice Mail Systems" under this, messages can be transmitted over telephone lines. At the receiving end, the sound waves are converted into digital pulses and stored for future retrieval. When required, we can get restructured speech. The receiver can store, delete or forward them to others.

ii) Transmission of documents and pictures:

Fax machine is a special type of Electronic mail. It is capable of scanning document including graphics and pictures. The transmission is via telephone lines to another FAX in another location. At the receiving end, an original copy of the document is recreated. Thus when transmission is completed, the receiving machine produces a facsimile a copy of the original. FAX is a growing business. It is faster and cheaper.

iii) Computerised conferences:

a) Bulletin Board system:

This provides a forum where users can check in at convenient times, post messages, participate in deleberations or just listen to the conversations of others. Unlike E-mail, a BBS message can be read by any Bulletin Board user, BBS is for a group of users. On the cases of E-mail, messages are addressed to a specific person.

b) Teleconferencing:

BBS allows users to participate in informal conferences. But teleconferences are most structured but use the same approach of as BBS. These conferences are held at the convenience of the participants. As the conference dialogue can be stored, it is not necessary for all the participants to be on line at their terminals at the same time. Several participants can also talk at the same time. A permanent record of all discussions can be maintained.

c) Videoconferencing:

It is the electronic linking of geographically scattered people who participate at the same time. Facsimile devices, electronic black boards, TV monitors desktop picture phones etc are some of the technologies used. Thus time and money spent on travelling long distances is saved.

Smart card:

Though smart card is similar to a bank card in appearence, it is deceptive in the sense that it is not just another bank card, but a new generation portable computer. "Smart card is a plastic card with a chip embedded; an electronic purse which enables the holder to load a card with a few thousand rupees- then withdraw or debit the amount at various POS terminals (Point of SALES)- will make their appearence any day now ("Source: Hindu dated 11.7.1996 p.26).

Thus the smart card has an embedded microprocessor and

memory chip. It is in effect a simplified computer on a card. It enables the account holder to do shopping without having to carry any cash. For example a customer wants to do shopping for upto Rs.5000 Instead of carrying the 5000, he can transfer Rs.5000 from his savings account to the card.

It is enough to carry the card instead of the Rs.5000. Each time he makes a purchase, the amount is deducted from the balance. The customer continues to make purchases till his electronic cash is exhausted. It is carried out with the help of ATMS.

Evolution of Smart Card:

The 1920's and 30s saw the advent of some embossed metal and plastic cards. In 1969, the first magnetic stripes were added to the embossed cards to ensure that the cards could be used worldwide and the International Standards Organisation (ISO) laid down standards covering various aspects of the cards including the dimensions, embossing and location of the magnetic stripen. To counter the threats of card related crimes and frauds, various security features such as holograms, fine background printing and signature panels have been introduced.

In 1974 Roland Moreno, a French Journalist, patented his idea of putting a chip inside a conventional plastic card. Dr. Kunitaka Arimura of Japan, also was granted a patent for smart cards and today all smart cards made in Japan have to be licensed by his Arimura Institute.Various other companies like smart card International, Philips, Honey well Bull and GEC among others, started using the Intel chips. In Japan and the USA some people were taking the smart card a stage further and designing the concept of a smart card with a display and keyboard-this concept came to be known as the super smart card. In 1989 the ISO set up a working group to set the standards for the smart cards- the standards cover such items as the contact position, interface protocol and information content and control.

Types of Smart Cards:

The smart card is a card which contains a large amount of

memory and have processing power and is capable of being packaged in the format laid down by the ISO. There are three types of smart cards i) contact card ii) contact less card and iii) super smart card.

Contact card has a micro electronics embedded in the card, which is connected to a metallic contact pad on the surface of the card. The contacts are linked by the read/write unit.

Contact less card is a means of transferring data between a smart card and a read/write device. The card is able to operate a small distance away from the surface of the read/write unit.

The super smart card has a keyboard and liquid crystal display (LCD). It can function more like a stand-alone terminal without the need of a read/write unit. The other types are magnetic stripe card, chip card, laser card and token. These cards have contact less memory cards and have been developed for specific applications.

Financial Applications:

The world of banking, insurance, wholesale and retail business are some of the major application are for smart-cards. It can be used during Electronic Funds Transfer at the Point of Sale (EFPOS). The card is placed in the reader. After getting through authentification process, the cardholders bank a/c is automatically debited and the retailer's a/c is credited.

Funds can be loaded into a card for use as cash. This electronic cash can then be used for making purchases without requiring the authorisation of a PIN; the retailer presents the information to the bank so that his a/c can be credited.

Other areas of Application:

There are a number of possible application is the other areas

- to store vital medical informations
- to procure tickets during travel

prepared telephone cards, credit card telephone are some more examples of the uses of smart cards.

Advantages of Smart Cards:

i) Since the smart card has its own microprocessor it is very difficult to duplicate. Thus it provides greater security.

ii) Since there is no necessity for the banks to connect on-line to the banks main computer, this saves the bank significant amount by way of reduced communication cost.

iii) Storage capacity is larger than a magnetic stripe card.

Popularity of Smart Cards:

France has contributed considerably through the introduction of smart cards. In 1967, the first payment cards were introduced in France. In 1971, magnetic stripes were added. In 1986, a memory chip was incorporated in the smart cards. In India, Dena Bank recently launched the smart card in Mumbai. Others are on the way.

E-Money / E-Cash:

E-cash, Digi cash or cyber cash the names may vary but the idea is the same. In the simplest form, the cards used for e-cash are prepaid debit cards. A customer can get a card on payment of the desired amount. For example if a customer pays Rs.10000, he can get the card for this value. He can approach payment machines located at many places such as airports, bus terminals, shopping arcades etc. and draw cash are and when he needs money. He can use it till he reaches the card's limit. This card is programmed with a security code known to the customer only. This is more or less a smart card. It can be used to transfer funds from one account to another account.

One of the most established example of electronic cash is Digicash. A Dutch company founded by David Chaum and based in Amsterdam is responsible for the development of e-cash. It calls e-cash as Digi cash. E-cash is a completely anonymous electronic

cash system. It dispenses with the need for a pucca account as required in the case of ATM. When a person wants, he can set up an account and should pay the real money into his account and connect the bank account over the Internet. The customer has to decide how much amount he wants to hold as e-cash on his personal computer. After having decided the amount of e-cash, it will be downloaded to his personal computer, and stored in the hard disk. Then he can make purchase from a merchant (who has also an account connected over the internet.) The software transfers the e-cash from his personal computer to the merchant. He can deposit such e-cash into his e-cash account.

The e-cash system requires three main persons: banks, buyers and merchants. The banks convert real money into electronic money. Buyers have accounts with a bank from which they can deposit or withdraw e-cash. Merchants accept e-cash for goods sold/ services rendered.

Digicash has been running an e-cash trial since 1994, attracting some 30000 participants. The whole idea of e-cash is to permit electronic transactions with greater protection for consumer privacy. It offers a superior means of exchange in the electronic context providing instant settlement, easy storage etc., If large number of people start using this system, the size of the database may become very large and unmanageable. The e-cash must have network reliability. From the experiences it is learnt that networks always suffer from integrity problems at times.

ELECTRONIC DATA INTERCHANGE (EDI):

According to S.K.Basandra and S.Jaiswal, well known authorities on EDI, Electronic Data Interchange is the electronic transfer of structural business documents in an organisation - internally among groups of departments or externally with its supplies, customers, banks, governmental agencies and subsidiaries. Source: Doing away with paper, electronically, J.V.N.D.Prasad, Hindu dated 4.41997,p23).

This is a concept similar to SWIFT but within the country. If standard formats are devised for various commercial transactions/reporting among traders/industries, Governments

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commercial agencies and financial institutions, there will be a lot of savings in terms of information exchange and paper work among the agencies.

Documents used in EDI:

The documents that are used in EDI are invoices, purchases orders, shopping requests, acknowledgements and payments. EDI is quite different from the generic correspondence such as e-mail and involves exchange of specific documents with management procedure designed to efficiency. It includes value-added services such as transfer of funds, electronic forms and bulletin board and catalog services apart from e-mail.

Need for EDI:

In the traditional mode of conducting business through ordinary mail or e-mail and telephone, the link between a company and the outside world is limited. In that, the transactions through either telephone or the ordinary mail (or e-mail) terminates within the four wall of the people who operate the telephone or use the computer. The requisite is reached over the phone or e-mail. Cheques or drafts have to be sent manually. But in electronic mode, there are no delays or manual handling of documents. For example: Payments to banks or financial institutions is made via the computer. An example of partial implementation of EDI is the ATM in banks where EDI is used for transferring and withdrawing funds between different bank accounts.

How does EDI work?

The application program generates a file at the sender's end which contains the processed document.

The document is converted into an agreed standard format. The file containing the document is sent electronically over the network which links the originating company and its trading partner to the destination. The file containing the documents arrives at the trading partner (destination point) and this is translated into the correct format and transferred to the recipient's application.

To conclude, EDI can be effectively achieved only through computer network and related technologies. It has its application in port Trust clearing and forwarding houses, Govt. departments, customers, the RBI etc., The backbone of EDI is a strong and reliable high speed data communication network. Already steps have been taken at the Govt. level to formulate the operational and legal procedures for EDI.

5.6 MICR (Magnetic Ink Character Reader):

MICR technology technique is widely used by banks in India to process the tremendous amount of cheques being written every day. This method has established a certain amount of discipline in the matter of processing of cheques. The cheques are precoded with the cheque number, the branch number etc at the bottom of the cheques. These number and other special symbols are printed with a special ink that contains magnetizable particle of iron oxide.

Employees at the first bank receive the cheque after it has been written and use the same ink to encode the amount in the lower right corner. The cheque can then be processed by the machines. Cheques are accumulated into batches and placed in the input hopper of a reader-sorter unit. As they enter the reading unit, the cheques pass through the magnetic field, which causes the particles in the ink to become magnetised. The characters are then interpreted by "Read heads" as the cheques pass through the reading unit. The data being read can be entered directly into a computer or they can be transferred to magnetic tape for later processing.

A committee appointed by the RBI recommended the application of MICR technology for cheques in the town metropolitan centres in the first phase. Under the MICR system cheques and other instruments to be processed have certain special characteristics

i) Standard size
ii) Printed on special quality paper
iii) The particulars to be placed at the bottom should be printed in magnetic ink.

Before the introduction of MICR system, the bank cheques varied widely in regard to size, paper quality, printing, layout etc. Under MICR the machine is to do the reading and sorting standardisation was felt recenary. Hence the following two sizes have been stipulated for clearing the instruments.

Savings Bank cheques and Traveller's cheque	6.5" * 2.33"
Current account cheques Demand drafts. Dividend and interest warrants etc	8" * 3.67"

When the cheques are passed through the reader-sorted machines, they are sorted at high speed according to the information printed at bottom of the cheque in magnetic ink. Simultaneously, the machine sorts according to city/bank/branch and transaction code numbers. The machine can handle 600-2000 instruments per minute.

ADVANTAGES of MICR:

There are several advantages associated with the use of MICR

i) Instruments are read with a high degree of accuracy.

ii) Instruments are sorted at a speed of 2000 cheques per minute by the reader-sorter.

iii) People can easily read with the magnetic ink character.

iv) As the reader-sorter is connected to a computer, settlement position is known immediately.

v) Standardisation of formats of instruments avoids customer confusion in dealing with a variety of instruments from various banks.

vi) An a result of introduction of MICR clearing of instruments now takes 3 days and inter-city cleaning 4 days thus improving customer service.

DISADVANTAGES of MICR:

i) The instruments have to be handled carefully. Folding, Smearing, Stamping etc will lead to lack of accuracy while read by a machine.

ii) The magnetic strength of MICR characters tends to diminish over time. This will make the instruments unreliable.

Types of MICR fonts:

Early in 1966, two standard MICR fonts were accepted by the international standard organination:

i) EBB and ii) CMCT

EBB is used in the USA and in the UK. It consists of 0_9 and four special characters this is used for principliy for bank cheques. It originated in the USA.

CMC 7 Originated in France and is used in Europe. It includes 0-9,letters of alphabets and five special characters.

Hardware For MICR Technology:

Two specialised Machines are used:

i) Encoder: The encoder is a small electronic machine. It is used to perform the following functions:

a) to encode the amount in special ink which can be read by the reader _sorter.

b) to print the list of amounts of all the encoded instruments.

c) to place a clearing and enforcement stamp on the back of the instrument.

ii) **Reader_norter:**

After encoding, the cheques and accumulated into batches and placed in the input hopper of a reader_norter unit. An they enter the reading uint, the cheques pass through a magnetic field which causes the particulars in the ink to become magnitised. 'Read Heads' are then able to interpret the characters as the cheques pass through the reading unit. The data being read can be entered directly into the CPU for processing lates. Simultaneously the instruments are stored into differences pockets according to city /bank/branch. The machine can handle 600_300 documents per minute.

5.7 OPTICAL CHARACTER READER:

Optical character Recognition technique permits direct reading of any printed character. No special ink is required. They are designed to interpret handmade marks and characters machine printed characters and special bar codes. The OCR examines each character. Once the whole character has been scanned, the pattern recognised is matched against a set of patterns stored in the computer. If a scanned character matches with patterned character, it will be considered for further processing. If it does not match, it will be rejected. The OCR can read at a maximum rate of 2400 characters per second. But they are designed to operate at slower speed, say 300-800 characters per second, to ensure accuracy.

A wide range of fonts, using ordinary inks, can now be accepted by the OCRs. The common fonts used are OCR-A (American Standard) and OCR-B (European-standard) some OCRs accept computer print-out.

Many business organisation with a large volume of transactions make use of OCR for processing of data. Credit Card companies prepare bills with characters that can be read by the optical scanners. When customers make their payments, they are instructed to return the bill along with their cheques. The documents are then entered directly into the optical reader to update their accounts.

At present in India, the OCR is used for recruitment of

candidates into the Banking Industry by the National Institute of Banking Personnel Selection. The responses indicated by the candidates on the answer sheets are read by the machine by comparing the responses with the correct answers, the machine gives scores to the candidates. Thereafter it ranks the candidates in the order of their scores and finalises the merit list. The entire process eliminates the possibility of human errors.

Another use is in the area of reading of signatures by the optical scanners. The specimen signature storage and retrieval system is in use in Foreign Banks in India, it verifies the signature of the account holder. If it matches with specimen signature already fed in the transaction will be carried out further. If it does not match, it will be rejected.

The primary advantage of OCR is that it eliminates some of the duplication of human effort required to get data into the computer, thereby avoiding data transcriptor.

5.8 INTER-BRANCH RECONCILIATION:

Inter-branch transactions take place in the banking system because in certain transactions money is received at one branch and is paid at another branch for example. When a customer purchases a draft at Madurai branch of Canara Bank, money is received at that branch. When it is encashed at the Coimbatore branch of Canara bank, it pays the money. Book entries are passed at both the branches to indicate the transfer of money, though money is not actually transferred. These entries are reconciled at the bank's head office to ensure that the transaction is proper and complete. The system of reconciliation varies from bank to bank but the underlying principle is the same. (All the inter-branch transactions are maintained is one of the general ledger accounts. Any unreconciled transaction on debit side indicates potential fraud).

When a branch issues an instrument on another branch, it gives credit to that directly or through the account in the head office. It is called originating credit. The branch which pays money on the instrument, gives debit to the branch (which issued such instrument) either directly or through the account in the head

office. It is called responding credit. All the branches send a statement (called advice) to the head office on daily basis showing the name, code number etc of both the branches and the full details of transactions. On any day, branch will have a number of such originating and responding debits and credits. All these transactions are dealt in an inter-branch a/c of that branch. The inter-branch transactions are maintained in one of the general ledger accounts in the head office. To reconcile the entries, the statements submitted by the branches have to be gone through carefully to locate matching entries. Sometimes there could be slight difference in the particulars of entries due to negligence or illegible handwriting, through the entries are the proper pair. If reconciliation is done manually, it will be monotonous and a tedious job and also it will lead to a position where a large number of entries are unreconciled.

NEED FOR COMPUTERISATION:

In 1983, Era Chezhian committee on papers Tabled in the RajyaSabha commenting on the Eight Report on nationalised Banks took a serious view of the fact that some of the nationalised banks could not reconcile the inter-branch transactions completely. An such crores of rupees were unreconciled.

This situation arises due to the following factors

i) increase in the number of bank branches
ii) increase in the volume of inter-branch transactions.
iii) delays on the part of branches to despatch the originating credit/debit entries and in responding to the entries originated on them by other branches.
iv) Clerical errors such as illegible hand writing, writing wrong code numbers etc.
v) delays on the part of branches in matching unreconciled entries, even after recieving the list of such entries.
vi) centralisation of reconciliation function.
vii) loss due to blocked funds.
viii) risk of funds
ix) cost of manual work force
x) monotonous and boring work

Thereafter it is best to leave it to computers. To reconcile inter-branch transactions it requires computerisation at two levels,

i) computerisation at Apex level
ii) computerisation at Regional level

Computerisation at Apex level:

The apex body i.e. head office has

- to reconcile a large number of inter-branch transactions

- to generate reports at frequent intervals

In view of the above it must have a mainframe computer with any number of terminals depending upon the volume of transactions.

Pre-requisite for computerisation:

- all the summaries reports etc submitted by branches should be in standard specified and uniform formats.

- All the details like orgination and responding branches, type of transaction etc should be properly coded.

Benefits of computerisation:

i) speed and accurate reconciliation

ii) elimination of tedious manual labour

iii) generation of reports/statements

- branch-wise statements of daily reports received and remainders to defaulting branches.
- advices to branches in respect of unmatched entries
- complete statements of accounts of inter-branch transactions

- transactions branch wise, zone-wise and all bank level.
- availability of instant information for management for follow up.
- identification of malpractices if any

Computerisation of Regional Level:

When branches expand in size, the number of branches controlled by a regional office also increases. Hence it becomes essential to exercise effective control over inter-branch reconciliation at regional level. As such at the regional level the system to be used is a mini-computer with multiple terminals.

It results in the following benefits.

- faster reconciliation of inter-branch entries.
- prompt submission of returns to head office and RBI
- Immediate enquiry as to unmatched entries.
- Speedy follow up

In 1980 it was suggested that software should be uniform and the hardware would be left to the discretion of the banks concerned.

Now computers have been widely used in respect of inter-branch reconciliation and foreign exchange transactions.

Computerised system for INTER-BRANCH TRANSACTION:

Most banks have a centralised main-frame for this purpose. The system of reconciliation may differ from bank. But the following are the salient features.

i) creation of transaction file:

A separate file by name transaction file must be created for each branch. The daily summaries submitted by a ranch in respect of all the originating and responding entries are entered in the file with necessary codes.

ii) Creation of summary file:

A summary file must be created for each branch. It must give the opening balance, closing balance and details of debits and credits.

iii) Generation of Daily Reports:

Before editing the transaction file and summary file, a statements must be prepared datewise and branch wise so that it is easy to find out the branches which have not submitted the reports Remainders to the defaulting branches are generated at this stage.

iv) Editing of files:

This is done to weed out invalid entries. For example entries with wrong dates, invalid codes etc, will have to be eliminated before processing. For originating branches entries, the reporting branch code and the origination branch code should be identical. For reopening entries, the reporting branch code and the reopening branch should be identical.

v) Processing:

The transactions file is segregated into two subfiles one for originating entries and another for responding entries. These two files are sorted according to the originating branch data of transactions and amount. These two files are matched, When there is perfect match, it means that the entry is fully reconciled. Unmatched entries will be printed.

vi) Unreconciled entries:

The details of unmatched entries are taken and they are seriously viewed by the head office. These are sent to the respective branches for further consideration in this regard, the head office seeks a revised summary regarding unmatched entries. The revised summary goes through the same process as mentioned above.

5.8 HOME BANKING:

This is the service by which bank customers are enabled to conduct money transfers and other basic banking transactions with the help of a telephone and a television set. By means of a keyword, the viewer can select any 'page' of information on a wide range of subjects. For example, he can book airline tickets, obtain information on a wide range of subjects and make retail purchases. The first application of this facility was introduced in 1983 in the UK by the Nottingham Building society and the Bank of Scotland in cooperation with British Telecom.

It has become possible for an investor in the building society to obtain from his television screen, details of his account, make transfers of funds between the building society and the bank of Scotland and to instruct the bank to make normal current account payments. In 1985, the Bank of Scotland introduced home banking for its own customers. Earlier experiments in home banking had been conducted by Citibank and Chemical Bank in the U.S.A and by Verbraucher bank in Germany. Since then, home banking services have been introduced in a number of banks in other countries. In India, only a few banks have introduced corporate banking. This enables the corporate customers to get updates on their accounts and pass on suitable instructions to the bank. The Rangarajan Committee (1989) has suggested that with the expansion of communications network, it should be possible to provide the facility to large customers.

5.9 Internet:

In the field of information technology (IT), internet, as a tool of global communication, has occupied an important place. It has pervaded all wales of our life. It is very difficult to define what is internet. In ordinary sense internet is a collection of large number of heterogeneous data networks connected together to share data among the network. It is world largest computers world network. It is not a really a networks, all freely exchange information. There are 35 millions internet users worldwide and two millions internet lost systems.(network an internet user can connect to).

HISTORY:

The internet origin dates back to the date 1960's in America. The US government backed advanced research projects agency (ARPA) developed computer protocols. (a protocol is a piece of software which has the ability to bring together two different pieces of software running on incompatible platforms).The other objective of the arpa was to build a reliable and re-silent network backbone this involves dynamic enrouting. One of the networks links gets disrupted by enemy attach. To the traffic on it can be automatically en-routed through other links. The next step came in 1970's when a growing number of educational and research establishments had developed their own computer networks. They wanted to join together. An a result, the first routing system was developed and the concept of 'Network of Networks' and 'Inter-networking' (hence the name internet) were born.

Only in the middle of 1980's, the US National Science Foundation (NSF) had created a network of super computers (this has been developed as a core of Internet), using two simple protocols. The first is for transmission (is transmission of information to an addressed receiver) popularly known as 'Transmission Control Protocol (TCP) and the second in for internetworking known as internetworking Protocol (IP).Thus TCP/IP are the standard protocols for all networks forming part of the Internet. Only in the late 1980's, the NSF introduced the Internet to the general public. In may 1995, the NSF ceased its involvement and the internet is no longer US give to backed. It is now universal network and a wholly commercial network. Now it has become a reservoir of information on all topics of internet.

Hardware and Software requirements:

The following minimum components and equipments are needed to get an Internet connectivity:

- a pentium processor
- 16 MB RAM
- 1 GB Hard disk drive
- a 25.5/14.4 kbps modem with fase facility.
- a color monitor
- windows 95 and microsoft plus software

PROVIDERS OF INTERNET CONNECTIVITY:

Actual internet connectivity is provided by the followin; Internet service providers (ISP)

i) VSNL (Videsh Sanchar Nigem limited)
ii) DOT (Department of Telecommunication)

They are authorised by Inter NIC to allot Internet addresses to the clients these ISPs have established an IAP (Internet Access Point). VSNL is connected by satellite links to the USA and to Europe through undersea cables.

Options available to subscribe to any one of the connectivity (also called accounts)

i) Shell account connectivity permits only text-based access through telephone lines for accessing the Internet host of the ISP Shell account is popular among students.

ii) TCP/IP connectivity provides direct connection betweeı client computer and the Internet host. We can download any kinc. of information into our PC.

iii) TCP/IP using leased links infact is the highest level of connectivity available through ISP

iv) Shell accounts are available through PSPDN (Packet Switched Public Data Network); ISDN (Integrated Services Digital Network) and leased line çonnection through PSPDN and ISDN

Internet Constituents:

The Internet has following constituents:

i) Word Wide Web (WWW)
ii) Electronic mail (E-MAIL)
iii) File Transfer Protocol (FTP)
iv) Gopher
v) IRC

World Wide Web:

The internet documents are called Web pages. Web uses Web pages to organise information. The computer storage area that controls the Web pages is called "Web site". To access these Web site, a client needs a program called "browser". Microsoft Internet Explorer and Netscape Navigator are two popular browsers dominating the market. The first page of a web site is called "Homepage". The Web combines text, pictures, sound and even animation .

Documents in the Websites are linked together by Hyper Text Markup Language (HTML) and support Hyper Text Transport Protocol (HTTP).

The amount of information contained is web sites is so vast. Educational institutions put various information such as courses available, contents of various information, eligibility of business organisations are the large contribution of Websites. They put information about their companies, products, market level, research etc. In the line of contribution are software companies, tourism industry, hotel industry, entertainment industry, libraries, research institutions, spiritual organisations and so on.

E-MAIL:

E-mail implies exchange of information electronically between computer interconnected by data transmission lines. This is the largest application of Internet. E-mail functions through the e-mail server located in the Internet host server of the ISP. When a customer signs for an internet account with an ISP, then an address is automatically assigned. E-mail address has two parts: user name and domain seperated by @. The domain part identifies the location of the E-mail server of ISP. For example

Username @ domain
info @ sims .edu
dalmiaind @vsnl.com

Some major top level domains (TLD) are given.

EDU	Educational site
NET	Network Administrative Oraganisation
COM	Commercial site
ORG	Non profit Oraganisation
IN	India
CA	Canada

FTP:

It is a tool used to download or upload information. We car copy files from a distant computer to the user's computer and vice-versa. Copies of historical documents, research papers etc are available for free through FTP.

Gopher:

This is a menu driven program which gives any access to other on-line databases and services by using selection or menu.

IRC:

Internet that provides us to communicate with people from all over the world, in real-time. This is a substitute for 'talk'. The larger networks have thousands of channels and you have to join one of them before you can talk with other people. It is even possible to have conversation on several channels at the same time.

Internet Utilities:

The following is the list of activities the user can go on the Internet:

i) Visit web sites.
ii) Send and receive electronic mail.
iii) Read and post articles in newsgroups.
iv) Down load files to your PC.
v) Chat with other users on-line.
vi) Play games with others on-line.

vii) Access on-line multimedia including radio and video broadcasts.

viii) Search the Internet for information.

ix) Subscribe to electronic newsletters, e-Zines etc.

x) Join contests.

xi) Contribute articles, and others materials.

xii) Do on-line shopping.

xiii) Post your resumes on the Internet.

xiv) Create your own web sites.

xv) Create an e-mail ID and account for you.

xvi) Use the e-mail, remainder service.

xvii) Find a person's details.

xviii) Send flowers or gifts to others.

The above list is not complete. There are a lot of things that you can do on the internet.

The banking and finance community is one of the best represented in Indian business directories on the net. Banks, in India, are using the Internet to attract NRI deposits. Apart from information electronic account opening from on their home pages which can be down loaded, printed, filled in and ported to them.

Intranet:

The internet boom has brought in a new concept- Intranet. In the last three years, corporate internets have quietly been gathering momentum in simple terms, Internet is an internet established within an organization. In fact. 70% of new web sites are designed for internet company use. As businesses are making

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their efforts to take advantage of internet technology within their cooperate precinets.(source computer education & training, vol.2 no.19, july 1-15.1998,32). Intranet technology is based on open, non property standards allowing for dreamless communication across multiple platforms and heterogenous operating systems.

Features of intranet:

If offers the following utility features;

i) open, non-prietary standards
ii) heterogenious platforms across networks
iii) lower cost of application, deployment and management
iv) universal access to information and applications
v) self-service information system
vi) lower training cost.

Advantages:

- It provides for value added benefits much as round the clock access to information
- If facilitates quick decision making
- Employees can be used efficiently
- With the information, we can create new market opportunities
- Sharing of information, through intranet based e-mail, is possible among the employees
- It dramatically reduces the manual efforts involved with human resources data management, expense reporting, purchase requisitions and approval processes.
- If provides a solid business foundation for companies to conduct electronic commerce through the internet.

Problems:

Since people have easy access to information. intranet must be secure. Secure intranet must provide;

- confidentiality of data
- data integrity
- user authentication
- secure movement of data within the intranet
- assurance to the users that the system is safe and secure.

5.11 Y2K Problem:

It will be a thrilling moment when the universe enters into the 21st century on 1.1.2000. It is unique day since the start of computer era. With the end of the century, our computer will no longer be able to differentiate one century from another with the last two digit to the year. Most programs and databases use two digits rather than four digit to represent the year in the data field when you put '97' the computer will take it as 1997. To represent the year 2000, when you put '00', the computer will take it as'1900' rather than '2000' and proceed to give incorrect calculations. Because it the omission of century information in data values, errors can occur in chronological date sorting, date comparisons, calculation of duration etc. It also arises whenever a calculation crosses the year 2000 boundary. The year 2000 is not a problem pertaining only to a mainframe Cobol. It applies to all languages, on all types to computer. Since move Cobol application on or the main computers, it happens to be a matter relating to Cobol. Y2K is all pervasive, as two digit year fields are everywhere. Dates are in microcode, queries, procedures, data screens and in system software. Consequently the year 2000 challenge affect any business, agency, institution or persons using computer.

In one way or other, year 2000 crisis touches the life of almost every person who relies (directly or indirectly) on it. The bank customers, both using it or not using it would suffer the consequences of year 2000. The problem of date is already emerging out. There are three approaches to solve the problem·

1. Expanding the year field to hold century information is permanent and less expensive approach. By this method dd/mm/yy may be changed to dd/mm/ccyy where cc represents century code.

2. Entering the current information through a century window. By this approach, for example the window range is 1.1.1956 through 31.12.2055. If two digit year is>=56, the century is inferred to be 19 otherwise if the two digit year is<=55,the century is inferred to be 20.

3. Compressing two digit years to two digit field. By this approach, four digit year is converted to packed decimal. But this has many limitations than other approaches.

5.12 VIRTUAL BANKING:

The concept of virtual banking, where the customer can make transaction from anywhere, anything in any way through a personal computer, the internet or over the phone has already become a reality in other countries. India is also forced to go the same way on account of liberalisation, the entry of transnational companies, the setting up of private sector and foreign banks.

Banking without bank premises:

In fact, the pressure of time, mobility and space has forced the industry to move towards providing a system where the customer can access information from his home known as home banking. This delivers all conventional services to the customers at home. Typically a customer can open an account through his personal computer, get details of the services offered by the bank and make enquiries. Even he can download electronic cash onto his smart card or electronic wallet. All these facilities are already available with Citibank in other countries.

Computers in and Customers out:

A customer can set up an account and pay the real money into this account and connect the account over the internet. He can download electronic cash to his personal computer.

Then he can make purchases from a merchant having his account connected over the internet. Thus the customer spends the money and the bank updates his account accordingly all without any cash actually charging hands. All without any cash actually charging hands. All these are possible with networking of computers in bank. Customers need not to go to the banks for personal interaction with the bank personnel. A day will come where the bank branch will be full of computers and not customers.

In India, the increase in the number of personal computers, increasing awareness of internet, familiarity with technology and the rising number of ATMS indicates its path to virtual bank.

5.13 Security Aspects In Mechanisation:

It is no doubt that the computerisation of banking operations has brought massive benefits to the computers but along with the gains of computerisation, security risks also arise.

Trusting the bank, the people deposit their money. They feel that a bank is a secure repository for their savings. Therefore in the sphere of mechanised banking security aspects assume prime importance.

A computerised system has to be protected against various risks such as

i. Natural calamities.
ii. Operational problems.
iii. Human errors.
iv. Malicious damage by people
v. Travdment activities of people.

Risk due to natural calamities:

Computer systems are vulnerable to damage from natural causes such as fire, flood, earthquake etc., buildings which house computer installations should be equipped with the latest warning system such smoke detectors etc., Fire fighting equipments need to be installed at appropriate points. Fire-proof equipment such as

rafes, filing cabinets etc., are to be used extensively. To prevent loss of data they should be stored as backup at some other locations.

Operational problems:

In the day to day functioning problems may occur in the form of break down in the power supply, malfunction in the computer system etc., If the computer is functioning in an on-line mode breakdown in the power supply will came serious consequences of the power supply to the central computer is disturbed, it will result in a complete breakdown of the system in the central area of data are not saved, we have to lose the data. critical functions such as funds transfer, automated teller operations. Foreign exchange dealings etc., will be temporarily suspended. To over come this, on-line uninterrupted power supply (UPS) is to be installed. In the event of power failure, the UPS will provide backup power immediately.

If the computer system malfunctions or breakdowns, the effects may be minor or it could be disastrous. It may disrupt the entire operation for a period of time. Banks having large number of computers must maintain spare of all crucial components so as to minimise the computer down-time.

Human errors:

To err is human. The result provides by the computer ids reliable only when the data supplied by the user to the computer system are correct of data are not reliable the results is also not reliable. As such, the importance is naturally placed on the data. In banks, erroneous data lead to a lot of problem. It is very difficult to trace an error because enormous amount of data are entered into the computer. Therefore data validation is done at each and every steps of data entry. Validation can protect against data duplication. The following measures may be used to prevent mistakes.

a) RECORD VALIDATION:

At the record level, the validation should ensure that all the necessary fields are complete. The fields should not be contradictory.

b) **ZERO PROOFING:**

By applying double entry system of book-keeping, data of debit nature should be equal to data of credit nature.

c) **TRANSACTION NUMBERS:**

An transactions occurs a number is allotted. This is done to ensure completeness of data and to guard against data duplication cheques are also numbered, so that one cheque number receives only one payment.

Malicious damage by people:

The greatest threat to any computer installation emanates from its own employees or from outside people (called hackers). A disgruntled or unhappy employee can create havoc in an organisation by sabotaging its computer system. An employee can obtain complete knowledge of the computer system and may cause damage to the computer system. An employee can obtain complete knowledge of the computer system and may cause damage to the computer system. He may cause a system failure by removing the software programs stored on the computer. Sometimes he can introduce viruses into the computer system. The following preventive measures may be adopted:

i. Maintaining a regular back-ups of all important data files and software programs in a safe place.

ii. Restricting access to the computer system only to the authorised personnel by the use of passwords authorised personnel may be assigned different password.

iii. Maintenance of an access log on the usage of the computer system. It contains the names of the persons who used the computer system files accessed by them and the duration of usage.

Hacking by outsiders is possible through public telephone network. In foreign countries, most computer installations have modems connected to the computers. Through modems, data are

transmitted to other computer systems. Outsiders can send and receive data from a computer installation by dialing the number on which the modem is connected to that computer installation. Through modems, hackers can cause incalculable damage to the banks using passwords, allocation of PIN (Personal Identification Numbers), encryption of all the modem lines etc., may be introduced as preventive measures against the hackers.

Risk due to fraudulent activities of the people:

Criminals use computers in a variety of ways. Criminals access bank computer system to transfer huge amounts of money to their own accounts. Thus, threat to computer operations arises not only from the failure of technology but also from criminal elements who manipulate the system for their personal profit. All organisations should have a security policy to protect themselves against such criminals.

5.14 Security considerations:-

Computer security is an important aspect when computer is used. When a branch/bank depends on computer system it becomes very essential to ensure that the computer application runs smoothly and any possible obstacle is removed at the beginning itself. It should be kept in mind that if there is any slip-up, the entire organisation will come to a grinding halt. To avoid this, the computer must be carefully maintained.

The security of computer involves

i) security of hardware
ii) security of software
iii) security of input data
iv) security of output

Security of hardware:

Among the four security aspects, security of hardware i.e. hardisk, CPU, input device etc remains most important. The hardware shall be protected against theft, fraud, malicious damage, fire, floods, storms, sabotage etc. The vulnerability of

computer systems has increased in recent years. So the security issue has become a more crucial.

In the early days, the access to computers was restricted only to a few specialists. Therefore, the system was secure. But now-a-days people will little knowledge in computer have free access to computers. They can cause damage to the system considerably. If in a branch, access to computer is not restricted, any aggrieved employee can damage the computer system, thereby bringing the entire branch to halt

Location of hardware:

The computer system should be located in a secure place. Ground floor/top most floor of the building should be avoided, as they are prone to flooding/leakage during monsoon. The cable of the computer line should be earthed to reduce aerial effect. The computer room should be secure from the following types of damages at the site

i) leakage in pipeline
ii) flooding by rain
iii) humidity due to poor air-conditioning
iv) fire and smokes
v) storms and lightening
vi) electromagnetic interference
vii) accidental emplosions
viii) theft of equipment

Preventive measures:

Preventive maintenance of the system, should be done periodically. Computers should be covered by anti-static dust free covers when not in use. The computer room should be kept neat and clean. In most data processing centres, the flooding is covered by vinyl covering so that cleaning is easier. Computer rooms should not be carpeted as they attract static electricity. The electricity supplied to the computers should be established through a stabiliser. The computer room should be air-conditioned. The air conditioners, stabilisers and the computer should be under an Annual Maintenance Contract (AMC).

Physical access:

Most data processing companies maintain a hardware backup. This is another computer system (i.e. spare system) similar to that of the original. It contains all the parts of a computer and works well. When main system fails, the backup is bought into full operation. When the computer system fails either due to accidental or malicious damage and replacement of parts is delayed by the vendor or the parts are not currently available in the market, the parts in the hardware backup will be used in the failed system so as to bring it in operation immediately. When there is a total power failure in the computer centre and shifting of the computer system is not possible, the hardware backup may be shifted to some other building where there is power supply.

Supply of software:

Access to software be strictly on 'need to know' basis. If the operator has no need to access to the source code (i.e., the original programs written in some computer language like COBOL, BASIC, C, etc.,) then he should not be allowed to know the source code. The following are some of the ways to ensure smooth running of software.

i) Training of staff on the use of the operating systems.
ii) Adherence to standards in programming
iii) Pre-testing the written software before it is actually given to the users for implementation.
iv) Separation of duties of programmers and operators.
v) Adherence of the software to specifications given by the users.
vi) obtaining formal approval from the users before final implementation.
vii) Documentation of the software and procedures.

Computer systems have passwords. The password may contain six or eight characters and each user is given a separate password. Only the user knows the password and when the password is communicated to the computer through the keyboard then only it gives access. The employees are also given different

passwords which restricts access to certain programs.

Normally password is changed every month. Whenever an employee resigns or is transferred, his password is removed from the computer system.

Only persons authorised to run a particular should be able to do it. In essence the computer system should be able to protect itself from unauthorised use.

Input data:

As a matter of principle , the only authorised data should be fed into the computer. Data entry forms should be free from errors as far as possible. Before inputting the data, they must be scrutinised to ensure that they are acceptable and are error-free. The input documents should be kept carefully as they are subject to audit by a separate staff-members.

Output documents:

The output can be in any form that is on the screen, on the paper or in the floppy or in the hard disk. There is a principle that only authorised persons should have access to it. For example in the fully computerised branch, the information should be terminal specific along with password. A current account clerk should be authorised to see only the current account balances on the screen from this terminal. The other operators, like savings bank account clerk, bank loan clerk etc should not be allowed to see the current account balances on their screen.

Data backup (a duplicate copy of the original data) should be taken regularly on floppies/hard disks and kept during all times only in the custody of the authorised persons. In the case of any damage to the data on the disk due to electrical fluctuations/bad media, the data should be restored from the backups. Power failures play havoc with data. To overcome this, Un-interruptible Power Supply (UPS) is to be provided. It provides electrical power to the computer system whenever the power fails. The UPS has batteries ranging from 30 minutes to 8 hours. Depending upon the need, the UPS is to be purchased. In most places in India, UPS is

an essential ingrediant of a computer set up.

ENCRYPTION is a method by which messages are coded before they are transmitted so that the receiver only can read the message in the original form after decoding it. Over hundred years, banks have been doing this. When funds are transferred by telex or telegram, the message is sent in a garbled is sent in a garbled form by the transmitting branch and the receiving branch decodes the message to its original form and takes action on it. It prevents others to make use of the data. It uses a mathematical algorithm to scramble information into a mass of apparently random number normally upto 56 computers bits long. This type of encryption is needed for coding and encoding the data. The most commonly used algorithm is the Data Encryption standard (DES) which handles data in blocks 64 bits long. In this method, a particular key is used for coding and decoding of data. Different keys are available in DES for coding and decoding.

Unlike the DES, there are other ciphers which use different but related keys at the other end. Both the techniques are known Public Encryption Systems, because there are two keys involved in each codification, Secret one and a Public one. The bank receiving a message has to calculate two keys. One is made for decoding messages is kept secret. The two keys are related mathematically and it is essential that an intruder into the system who gets hold of the public key should not be able to calculate the private (secret) key from it.

An additional safeguard for transmission of messages is authentication. All Electronic Funds Transfer (including SWIFT) messages carry authentication. Authentification is the means by which data being transferred or received can be traced back to verifiable source. All banking payment messages carry the transaction date, value date, account number, value of a transaction, bank/branch identification, etc Authentication enables the receiver to be sure that encrypted message is from an authentic sender and that the messages have not been altered during transmission.

Audit trails:

An audit trail is a record of transactions in an information system. It provides a means of identification and verification of the activity of an information systems. The simplest audit trail is the transaction itself. For example, if a person's salary is increased, the transaction (i.e., the data amount of increase and the authorising manager) becomes and audit trail for future enquiries. The audit trails should be properly defined, maintained, analysed, categorised and reported.

i) One method of generating an audit tail is that the computer system maintains a log of all input transactions. It keeps its eye on the transactions posted by the operator. In case if any variation, the audit trail provides necessary data about the posting of the voucher, its correction etc.

ii) Log of specific transactions: In case, it is not required to maintain a log of all input transactions, only a log of specific transactions can be kept say only Electronic Funds Transfers.

iii) Log of transactions on the basis of a particular criterion Transaction of value over a certain amount say Rs.100000 may be kept.

iv) Summary of transactions by type or by period:

The most desirable method of audit trail is to provide an audit trail for all transactions. The transactions may be grouped on the basis of its type or on the basis of period. On the basis of its type, the transaction may be grouped according to, for example, loan account. On the basis of period, they may be grouped say monthly, quarterly, etc, for the purpose of audit trails.

Course material prepared by:

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REVIEW QUESTIONS
(Lesson-5)

1. Give a detailed note on EFT and state its advantages over the other methods of transferring funds.

2. Describe the use of MICR technology in banks.

3. Comment on the necessity for an ATM network in banks.

4. What are the problems faced in manual reconciliation of Inter-branch transaction? How can computers help in overcoming these problems?

5. Suggest a control system to protect hardware and software in an organisation.

6. Enumerate the security considerations with regard to input data and output documents.

7. Write short notes on

   i) Home Banking
   ii) OCR
   iii) Audit Trails

8. How are inter-branch transactions reconciled through computers?

9. Give an outline on computerisation of banks in India.

10. Explain the role of SWIFT in data transmission among banks.

11. SMART CARD replaces real money - Discuss.

12. Internet- a revolution in Information Technology - Discuss.

13. Explain Internet and Intranet.

14. What do you mean by Y2k problem? How does it affect banking industry?

15. Give a detailed note on E-mail and its features.

16. In what way E-cash helps in transferring funds in banks?

17. Explain different networking systems used in banks.

ALAGAPPA UNIVERSITY, KARAIKUDI

M. B. M. (MASTER OF BANK MANAGEMENT)

COMPUTERS AND BANKING

MODEL QUESTION PAPER

Time : 3 Hours **Max. Marks : 100**

SECTION - A

(5 X 8 = 40 Marks)

Answer any FIVE of the following questions :

1. What is a computer? What are the characteristics of computer?
2. Give a brief note on the history of development of computers?
3. What are the components of a computer system?
4. Compare Batch Processing and On-Line Processing.
5. How are the printers classified? Explain them in detail.
6. Compare machine language, assembly language and high level languages.
7. Give a detailed note on EFT and state its advantages over the other methods of transferring funds.
8. Describe the use of MICR technology in banks.

SECTION - B

(4 X 15 = 60 Marks)

Answer any FOUR of the following questions :

9. State the different areas in which computers are used?
10. Explain different classification of computers on brief.
11. Briefly explain the need and use of character codes - ASCII and EBCDIC.
12. What is memory? What are the characteristic features of memory? Explain its types.
13. What do you mean by operating system? Explain its functions.
14. Give an outline on computerisation of banks in India.
15. What do you mean by Y2k problem? How does it affect banking industry?

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